THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. X. No. 224—13th YEAR.] LONDON, MAY 21, 1861. [Subscription per Ann. { 15s. in Advance / 18s Credit.] With SUPPLEMENT, Price 1s. 6d.

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The directors do not pledge themselves to accept the lowest Tender.

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May 8, 1861.

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May 8, 1861.

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J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire Bricks, and every other article in Fire Clay, are promptly executed at their Works as above.

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Original Manufacturers of Wrought-Iron Gas Tubes and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam Boilers.

J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest Orders may be executed in a few days.

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No waste of Gas, nor roasting of the men in charging and discharging Retorts.

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WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the Manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other Articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.

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TO GASHOLDER MAKERS.

THE Directors of the Wrexham GASLIGHT and COKE COMPANY are prepared to receive Tenders for the supply and erection of a TELESCOPIC GASHOLDER, 50 ft. diameter.

Plans and Specifications may be seen at the Company's Offices, on application to the Engineer at the Works.

All Tenders to be sent to the Chairman and Directors, endorsed "Tenders for Gasholder," to be delivered at the Works on or before May 31, 1861.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
CHARLES BARNETT, Secretary.
Wrexham Gas and Coke Company,
Wrexham, May 14, 1861.

COUNTY and General Gas Consumers COMPANY (LIMITED).—Works at Chertsey, Lea Bridge, Northfleet, Pembroke, Pembroke Dock, Ware, and Walton-on-Thames, producing a gas rental of about £6500 per annum.

Established for the erection of gas-works in provincial towns, or the purchase or leasing of existing works on equitable terms. Application to be made to the Engineer to the Company, Mr. H. P. STEPHENSON, 58, PALL MALL.

TO BE DISPOSED OF BY TENDER.

THE Directors of the Northampton GASLIGHT COMPANY invite Tenders for the COAL TAR, produced at their Works, for sale (about 70,000 gallons per annum), for One or more years, as may be agreed upon, from September next.

Further particulars may be learnt upon application to Mr. HUNTER JONES, at the Works.

TO BE SOLD, a Second-hand GASHOLDER, in good condition, 40 ft. by 12 ft. Counterbalanced at three points with 6-inch Inlet and Outlet-Pipes and Valves complete.

For price and further particulars, apply to Mr. HUNTER JONES, Gas-Works, NORTHAMPTON.

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ESTABLISHED 1840.

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Gas Engineers, and Manufacturers of Clay Retorts

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Retort Mouthpieces, Bolts, Nuts, and every description of Wrought-Iron Work.

THE IMPERIAL IRON TUBE COMPANY,
(SUCCESSORS TO GEORGE B. LLOYD & CO.,)
GAS STREET AND BERKLEY STREET,
BIRMINGHAM,
Manufacturers of Wrought-Iron Tubes and Fittings,
FOR GAS, STEAM, AND WATER.
PATENT GLASS ENAMELLED AND GALVANIZED TUBES,
AND
LAP-WELDED IRON BOILER TUBES.

JOURNAL OF GAS LIGHTING NEWSPAPER THREE HALF-PENCE

THREE
MEDALS AWARDED TO
THOMAS GLOVER'S
PATENT DRY GAS-METERS.

LORD REDESDALE'S "SALE OF GAS ACT."

DRY METERS *VERSUS* WET METERS.

LONDON, February 25, 1861.

THOMAS GLOVER begs to call the attention of Gas Companies and others to a few *facts*, which, if duly considered, must lead to most important conclusions :—

1. That since THOMAS GLOVER commenced to manufacture his Patent Dry Gas-Meters (which is now upwards of 15 years), every Wet Meter Maker of any importance in England has been compelled to manufacture Dry Gas-Meters; and in the JOURNAL OF GAS LIGHTING, of date of 12th of February, 1861, Messrs. William Parkinson and Co., successors to the late Samuel Crossley, advertise that they "intend manufacturing *Dry* as well as" Wet Meters, and it is worthy of particular notice that they intend to do so "after 40 years experience in manufacturing Wet Gas-Meters of such a quality that has enabled them, as they say, to maintain a superiority over all other; and this, be it also particularly noticed, after they had advertised in the JOURNAL OF GAS LIGHTING, January 29, 1861, "their improved low-spouted Gas-Meter with new patent float arrangement, which entirely overcomes the difficulty experienced by ordinary Wet Meter."

2. That it is quite consistent with THOMAS GLOVER'S knowledge that Wet Gas-Meters, called "low-spouted" or "compensating Wet Meters," have already been proved to be incapable of continuous working or registration, and for this reason the manufacturers of these Meters have been induced to seek the repeal of Lord Redesdale's (righteous) Sale of Gas Act.

3. That every year the Patent Dry Gas-Meter manufactured by THOMAS GLOVER has risen in favour with Gas Companies and Gas Consumers, placing him in the proud position of being the largest manufacturer of Gas-Meters in the country.

THOMAS GLOVER guarantees his Patent Dry Gas-Meters to meet all the requirements of the "Sale of Gas Act," to give accurate and unvarying registration with steady lights; and, from their peculiar construction, cannot be tampered with, and may be fixed in open situations even above or below the level of the lights. They work with less pressure than Wet Meters, and are not affected by the most severe frost.

THOMAS GLOVER guarantees to uphold all Meters sold by him for 5 years free of expense to the purchaser, or for a trifling per centage per annum will contract with any Gas Company to uphold their Meters of his manufacture for a series of years; and, at the conclusion of such contract, to lease the Meters all in perfect working order.

N. B.—Agents in several parts of England are wanted. Apply by letter, or personally.

WILLIAM PARKINSON AND CO.

(SUCCESSORS TO SAMUEL CROSLEY),

PATENT WET AND DRY GAS-METER MANUFACTURERS, &c.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

PATENT IMPROVED WET METER.

W. P. and Co. invite especial attention to this Meter, which entirely overcomes the difficulty to which ordinary Wet Meters are subjected, owing to the short range of the Float, which is necessary, in order to meet the requirements of the Sale of Gas Act.

"It is well known that in Meters constructed so that the valve will close when the water is drawn off to such a point as to render them 3 per cent. slow the lights are liable to be extinguished by the closing of the valve by a sudden increase of pressure. To meet this difficulty, Mr. Pinchbeck has invented an ingenious and simple arrangement by which the action is reversed, and any such increase of pressure, in his Meter, raises the value instead of depressing it. The fact of the improvement having been adopted by Messrs. W. Parkinson and Co. is a sufficient guarantee that it practically and effectually remedies the inconvenience it is designed to meet."—JOURNAL OF GAS LIGHTING.

IMPROVED DRY METER,

Which W. P. and Co. pledge themselves to manufacture with the same quality of materials and workmanship as in their Wet Meter, thereby giving Gas Companies and others the advantage of procuring a first-rate Dry as well as a Wet Meter, which, hitherto, they have been unable to do.

STATION-METERS AND GOVERNORS,

Which can be seen at all the London Gas-Works. Also Liverpool, Manchester, Sheffield, Nottingham, Belfast, Glasgow, Birmingham, Dublin, Bristol, Leeds, Leicester, Brighton, Southampton, Sunderland, Wolverhampton, Bradford, Norwich, &c., &c.

TEST GASHOLDERS, EXPERIMENTAL METERS, EXHAUSTER REGULATORS,

MINUTE CLOCKS, PRESSURE GAUGES, PHOTOMETERS, PRESSURE REGISTERS, &c.

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TO CORRESPONDENTS.

W. D.—*You can ascertain what you want from the formulæ given at pages 300 and 301 of the third edition of Clegg's Treatise, which contains the best article in our language on the subject. In the tables, one end of the pipe is presumed to be open, so that the pressure given indicates the loss between the two extremities.*

NOTICES.

The subscription is 15s. per annum, if paid in advance during the month of January, or 18s. credit, in two sums of 9s. each, in July and January of each year. Post-Office orders must be made payable at the Charing-Cross Money-Order Office, to William H. Bennett, No. 42, Parliament Street, Westminster.

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 21, 1861.

NOTES UPON PASSING EVENTS.

AN adjourned discussion on "The National Defences," at the Institution of Civil Engineers, on Tuesday last, brought out interesting views and facts on the many sides of this important question. Sir William Armstrong spoke in defence of his guns, and in explanation of his more recent improvements, especially applied to artillery of very heavy calibre. Into this description we shall not enter; because it would be difficult, if not impossible, to understand it without illustrative diagrams. Sir William made a sensation by stating that he by no means confined himself to his own inventions, but was prepared to use whatever he thought likely to be useful to the country, wherever and whenever suggested. His arrangement with the Government was to receive £2000 a year for ten years, and give up to the nation the benefit of all his past or future inventions "He had received no lumped sums of £20,000, or any other amount, as had been rumoured;" he was prepared, as he had informed the Secretary at War, to give up his ten years engagement at any time, if an earlier termination was considered likely to be for the interest of the department under his charge. It has been rumoured that, in spite of the favourable reports on the Armstrong guns made in the despatches of Sir Hope Grant, the commander of the forces in China, and repeated in public speeches by the Duke of Cambridge, the Royal Artillery officers have reported against their use, as dangerous to our own forces, from the liability of the lead coating the shells to strip, and injure skirmishers or other troops engaged in front of the guns. Rumours to this effect have been the common subject of conversation in military and scientific circles. In reference to these reports, Sir W. Armstrong said that it was true that his shells did sometimes strip at a distance of one hundred yards from the guns, and more frequently at the distance of two hundred yards. But, the defect was of rare occurrence, and one which could be remedied if desired by the artillery officers. These shells were built up in segments, and held together by a coating of lead, laid on in three ways: first, simply rolled round, so that it may be detached by manual force; secondly, poured on in a molten condition, and attached to the interior of the shell by undercut grooves; thirdly, attached to the shell by the zinc solder invented by Mr. Bashley Britten. But the object sought in the construction of a shell was that, on explosion, it break in as many pieces as possible, and the perfect attachment of the lead, by Mr. Britten's process, to a considerable extent defeated that object, diminishing the number of fragments by nearly one-half. It was for the artillery officers to decide whether they would obtain perfect safety by diminished efficiency. In Sir W. Armstrong's opinion, the second plan would be found safe and sufficiently effective. The explanations as to the cause of the long-promised and long-deferred trial between the Armstrong and Whitworth guns was less satisfactory. Mr. Whitworth proposed that his own servants should work his guns—that the results should be recorded and published. To these terms, the war authorities have not yet agreed. It will be regretted if the nation cannot have the services of both these distinguished mechanics.

On a totally different part of the question, Colonel Simmonds, R.E., expressed opinions which seemed to meet with very general concurrence. He protested against sinking vast sums of money, and frittering away our limited army by the erection of huge fortifications, each of which would require thousands of troops to man. He proposed to confine elaborate works of fortification to Portsmouth and the Isle of Wight, with the view of making that ample water-space safe by sea and land, and thus contribute to the base of operations for our channel fleet. There the largest fleet might assemble, or retire to, for refitting after an engagement. At all other ports or landing places liable to a *coup de main*, he would simply construct well protected batteries. He assumed that the point of an enemy, who had made a successful landing, would be the metropolis; that no invading army would waste time in besieging fortified places, but would march straight to the heart of commercial England—London. He, therefore, suggested the construction of two great camps, provided and prepared so as to form bases of operations for the regulars, militia, and volunteers, to be assembled there. These camps to be about twenty miles from London, one on the north and the other on the south side of the Thames. He considered that no invading army dare pass such camps, and that the armies assembled for defence would be able to give battle under the most favourable circumstances. This plan, which would be comparatively inexpensive, and would give *time*—the only element required to make this country completely victorious—even in case of invasion by such an army as that which, at six weeks notice, marched and conquered Lombardy. The conclusion and publication of this important discussion will be looked for with great interest.

The Thames embankment commissioners have at length concluded the most tiresome part of their duties. For the last fortnight, their office has been a perfect cave of Adullam for engineering projectors and dreamers. Every man with an "idea," down to the ingenious amateur who proposes to dam up the Thames at London Bridge, has pressed forward to unburden his crude conception. The commissioners have now to sift the wheat from the chaff; and, by an exhaustive and constructive process, arrive at what can be best done for a reasonable sum of money.

A fresh impetus has been given to the progress of steam cultivation by improvements recently patented, and brought into operation by Messrs. Howard, the celebrated plough makers of Bedford. They had previously sold upwards of a hundred of the apparatus patented by Mr. Smith, of Woolston. Messrs. Howard have succeeded in rendering the machinery lighter

and stronger, more effective, and cheaper. With the driving power of an ordinary 8-horse portable steam-engine, from seven to twelve acres can be broken up in one day—the extent varying, as the soil varies from the strongest clay to lighter loam—and from forty to fifty acres can be cultivated without removal of the engine or windlass. The following is a condensation of the makers' description :—

The new patent windlass is of simple construction. The winding drums or barrels, on which the steel-wire rope is coiled, revolve on a very strong wrought-iron axle, to which brackets are firmly fastened for carrying the pinion-shaft, and receiving a pair of wood shafts for moving the windlass about. On the extreme ends of the axle, a pair of high wood travelling wheels are fitted, which carry the whole. By this arrangement, whilst the weight is considerably reduced, the new patent windlass is rendered very portable, and is quickly set down to work where required. By a simple lever movement, the winding drums drop out of gear, and, at the same instant, come into contact with the friction-brake, which prevents the rope running off too fast. This plan enables the windlassman to give uninterrupted attention to the proper coiling of the rope, on which its preservation very much depends. It also prevents much loss of time at land's end, as the drums can instantly be thrown out of gear, or reversed, if necessary, even before the engine is stopped: in case of accidents, too, it enables the windlassman to stop the motion of the plough or cultivator in an instant. The pinion-wheels which gear into the drum-wheels, are keyed fast to the shaft; the liability to wear or breakage is thereby very much lessened, and the rattle occasioned by the old sliding pinions or clutches, which often prevented the signals being heard, is avoided.

The new patent steam cultivator is made entirely of wrought iron, with the exception of the wheels and shares, and is very light, although possessing great strength. It consists of a frame, in which the tines are placed, with a pair of wheels at each end, either of which can be fixed, or used for steering, according to the direction in which the implement is going. The tines are made double, each end carrying a share. A slight rocking movement is given to them, by which the hinder set of shares is raised a little: this contributes very much to the more efficient cultivation of the land, by lifting up and loosening the soil most thoroughly. As the implement is not turned at the end of the field, no time is lost, further than is required to reverse the engine, and move the snatch-block. The number of tines in the cultivator can be increased, and the distance apart regulated, according to the state of the land. The necessity for turning the implement round at land's end being obviated, not only saves much time, but the strain on the implement; and accidents by turning over are avoided. The shares also keep their full depth at the ends, and at starting. The engine can also be started at full speed, which is dangerous if working an implement that requires turning round.

The patent steam plough is very much on the same principle of construction as the patent cultivator, one set of ploughs being brought into work as the other set is taken out.

We have thought it worth while to give a paragraph to this description, because it at once received the approval of a number of tenant farmers, by whom some fifteen or twenty sets of the new apparatus were purchased, within a few days after it was made public. Mr. Fowler's steam plough is also coming rapidly into use, although much more expensive than Messrs. Howard. The manufacturers are said to be selling from one to two a week. Since sheep husbandry was popularized nearly a hundred years ago in Norfolk, the natural fertility of strong clay has not been found to compensate for the difficulties of cultivation. But steam cultivation, which is rapid and deep, and which dispenses with the baneful treading of horses, seems likely to restore strong clays to their ancient pre-eminence, and to develop in them a degree of fertility hitherto only known in rare and favourable seasons.

Circular to Gas Companies.

The determination of the Government with respect to the course they propose to take in dealing with the draft bill submitted to them for amending the Sale of Gas Act, has not yet been communicated to the sub-committee of the gas companies promoting the amendment; but we are in a position to announce that the assent of several of the principal metropolitan companies has been obtained to a measure which will, we apprehend, meet the urgent necessities of the case, and save from annihilation the large property which Lord Redesdale's Act has placed in jeopardy. We refrain from alluding further to the opposition raised in a quarter where support might have been expected, if only in acknowledgment of the great services rendered last year by the provincial gas companies to their London brethren, when the property of the latter was threatened with confiscation; and we do so because we conceive that some misapprehension exists on the part of this powerful body as to the effect of the proposed amendments, and also a forgetfulness of the danger they incur should a combination be formed amongst their customers to resist payment of their accounts. At all events, if their support cannot be obtained, the promoters of the movement for amending the Act have a right to look for their neutrality rather than to find them accomplices in an intrigue to defeat a movement which has the support of ninety-nine out of every hundred gas companies in the United Kingdom.

In a Supplement of the present number will be found an ample report of one of the most important inquiries ever instituted respecting the systems of supplying the large towns of this kingdom with gas. The Manchester corporation system, by which the gas consumer is charged a high price in order to relieve the ratepayer from charges which should fall equally on all, and the system of gas supply by private enterprise, under a regulated monopoly, were on trial in the case of the Bolton Corporation Bill before a committee of the House of Commons. The Bolton corporation, who were its promoters, sought for powers to enable them to purchase the works of the Bolton Gas Company by agreement, or, failing to complete such an arrangement, they sought power to establish gas-works of their own, to compete with the existing gas company. Twelve learned counsel occupied the attention of the committee for twelve days, during which they examined about fifty witnesses in the solution of the question raised by this application, and the result has been the establishment of a precedent which cannot fail to exercise a permanent influence on all future legislation on this subject. The committee refused to grant any competing powers for the supply of gas, but they have authorized the corporation to buy the existing gas-works, if, within five years, they can obtain the consent of the holders of three-fourths of the paid-up capital of the gas company. This authority is, however, accompanied with a prohibition to appropriate any of the gas profits to the general improvement of the town, or to any other purpose than the improvement and extension of the gas-works, if purchased. All money arising from gas-rents, and other income in respect of the gas-works so purchased, are to be applied, first, in payment of the interest of money borrowed under the authority of the Act; secondly, in payment of the current expenses incident to the supply of gas; thirdly, in providing a sinking-fund for paying off the money borrowed; fourthly, in carrying into execution the other purposes of the Act with respect to the supply of gas; and, fifthly, the surplus, if any, shall be, from time to time, applied for the formation of a reserve-fund, to the amount of £10,000, to answer any extraordinary claims which may arise against the corporation in respect of the gas-works. When the money arising from the gas-rents has been so appropriated, any further surplus is to be applied to the reduction of the charge for gas supplied.

This strict limitation by the committee of the profits arising from the sale of gas, and the withholding of the competing powers sought by the corporation, may be considered to render the bill a practical nullity, as regards its effect on the Bolton Gas Company. The present market value of the old (£16. 10s.) shares, which are entitled to a dividend of 10 per cent., is £40; and the value of the new shares, on which £3. 10. has been paid, and £13 remains uncalled, and which are entitled to a dividend of 6½ per cent., is £5. 5s. At those prices, it would require nearly £200,000 to purchase the undertaking, and there is little probability of the ratepayers generally burdening themselves with such a debt for the benefit of the gas consumers alone: for the latter would enjoy all the profit, while the ratepayers would incur all the risk. The benefit to the gas consumers even would be somewhat problematical if the measure were carried into effect; and it is quite certain that they will suffer loss by the efforts of the corporation to get the supply of gas into their own hands. The present price of gas in Bolton is 3s. 6d. per 1000 cubic feet, with a prospect of a reduction in the course of a short time by the operation of the Gas-Works Clauses Act, as the reserve-fund would this year have attained its prescribed amount, had not some portion of that fund been absorbed in this contest with the corporation. Power was sought by the bill to raise the price to 5s., and to maintain it at that standard by removing the obligations of the restrictive provisions of the Gas-Works Clauses Act in respect of profits. Had the Act been passed in that form, the corporation could have increased the present price 1s. 6d. per 1000 feet, and they would, by that means, have extracted £9000 per annum from the gas consumers, had not Parliament protected them, by requiring that all profits should be applied to the reduction of the price of gas. It was urged, on the part of the promoters of the bill, that the Bolton Gas Company, having attained its maximum dividend, had no inducement to extend the works, and supply the public wants; but, as £13 per share is still uncalled for on the new shares, and the additional premium which those shares would bear when fully paid up cannot be estimated at less than £60,000, there remains ample inducement for calling up capital whenever it can be profitably invested.

There has been no case relating to the supply of gas, since that of the London and Westminster Oil Gas Bill in 1824 and 1825, in which all parties have been so completely heard. A strong committee would have refused to hear much of the evidence tendered in the Bolton case, but, beyond an unreported interference of one member of the committee, no attempt was made to shorten the proceedings, and all parties were permitted to exhaust their cases. Mr. Alderman Livesey, Mr. D. Chadwick, and Mr. Hughes were allowed to indulge their peculiar crotchets; their direct evidence being contradicted by their cross-examinations. According to their statements, the profits of gas-works in the hands of public boards amount to marvellous sums, reaching in one year, in Salford, for example, to more than 25 per cent. on the capital employed; it being the object of such witnesses to impress on the committee the advantage to the public of being permitted to share in these good things. They forgot, however, to mention that by the operation of the Gas-Works Clauses Act, which the Bolton corporation attempted to evade, the profits of no company can exceed 10 per cent., and that the Bolton company could only divide 6½ per cent. on a large portion of its capital. Mr. Hughes and his bromine test got severely handled during cross-examination. It is well known that he travels with his "Cooper's tube," and that he is prepared to say what is the value of any gas by the indications of that instrument. He was compelled, however, to admit that he has to resort to the photometer to ascertain the coefficient to be used as a multiplier for converting the per centage of absorption by bromine into the value in illuminating power. According to Mr. Hughes, 6 per cent. of condensation is equivalent to 15 candles, while 13·1 per cent of condensation in the gas made at some mill in the vicinity is called the equivalent of 29 candle-gas. In one case, the coefficient used was 2·5, and, in the other, without the slightest authority, it was reduced to little more than 2. Indeed, he now admits the truth of what we have long asserted, that various qualities of coal require different coefficients; and, we have stated that this variation ranges from 1·5 to 3·5. It was no doubt in consequence of some inaccuracy in this respect that Mr. Hughes estimated the illuminating power of the Birmingham gas, on the 22nd of February, 1860, at 16 candles, as recorded in one of his tables produced before the committee on the Metropolis Gas Bill of 1860, while the company have never claimed for their gas a higher illuminating power than 12½ candles. In the hands of an experienced chemist, like Mr. H. H. Watson, the oxygen test is the most certain of all the chemical tests, and his coefficient, ·1334 appears to indicate with accuracy the illuminating power, in sperm candles, of any gas when consumed at the rate of 5 feet per hour in burners of suitable construction for the combustion of that quantity of gas.

It is to be hoped that the precedent established by the committee on the Bolton Corporation Gas Bill, will give a check to the hitherto advancing progress of public opinion towards the management of gas-works by municipal boards. A dividend of 10 per cent. is no doubt a tempting prize to seize on; but, when it is known that the full equivalent value must be paid for possessing the treasure, it will cease to become an object of desire. The refusal of the committee to grant competing powers to a corporation, which are generally sought for with the view of making better bargains with existing gas companies, will also tend materially to put a stop to the efforts that have been made to crush private enterprise. At all events, such will be the result when the consumers of gas bestir themselves, and take proper measures to prevent their being taxed to pay for town improvements and expenses, which should be borne by the ratepayers at large, and not thrown exclusively upon that portion of the public which happens to be consumers of gas.

We are compelled, by the great pressure of matter on our columns, to defer till our next publication the report of proceedings in a committee of the House of Lords on the Huddersfield Gas Bill, which occupied four days, and ended by a signal defeat of the commissioners, even more complete than in the Commons. We have previously noticed some of the peculiar features of the opposition raised to the application for an Act, simply to obtain parliamentary powers, by an existing gas company. The object of the commissioners, pushed onward by mob-orators, was to reduce the price that had been agreed on for the sale of the undertaking. In this shameful attempt, they were frustrated in the Commons, and the Lords also refused to listen to any other substantial alteration than the obligation to supply gas to the public lamps at 2s. 6d. per 1000 feet—the present contract being at a price per lamp that yields only about 2s. 1d. To this concession, if it may so be called, the company would, no doubt, have gladly assented, if properly applied to, without being driven to advance the price for public lighting by a parliamentary committee. It was attempted to defeat the bill in the Lords, by petitioning for the introduction of the clauses struck out in the committee of the Commons, empowering the commissioners to purchase the works of the gas company. Had the Lords consented to the reintroduction of those clauses, it would have been fatal to the bill as it would have been contrary to the forms of the House of Commons. But this disgraceful artifice was fortunately detected. The commissioners were, at all events, determined to reduce the estimated value of the share capital of the company from £60,000 to £40,000. Having failed to do that, they must now make up their minds, either to abandon the purchase altogether, or to pay a fair price for the undertaking, subject also to the probable conditions as to the appropriation of profits which have been imposed on the Bolton corporation.

The absence of Mr. Hughes from the Lords committee was the subject of general observation. In the Commons, he was one of the principal witnesses for the opposition, but his further services have apparently been somewhat discourteously rejected, and he has been supplanted by Messrs. Anderson and Penny, who seem desirous to become the Flintoffs of the south. This is the more remarkable, to say the least of it, as we understand it was through Mr. Hughes's introduction that the latter gentlemen came to be employed by the commissioners.

Mr. Flintoff, the real Simon Pure, has been repeating his thrice-told tale to audiences in Edinburgh, which city continues to be honoured with his presence. We observe that the same parties preside, that the meetings are held in the same places, and the majority of the individuals constituting them, we have little doubt, are also the same. Under these circumstances, it would defy even the eloquence of a Flintoff to keep up the excitement long. We may expect, therefore, to hear of its gradual decease by natural process of exhaustion, unless something extraordinary should occur to keep it alive.

A correspondent at Barcelona, whose attention has been drawn to the appeal of Joseph Wakeman, in our JOURNAL of March 12, suggests, as the most appropriate means of relieving such cases of distress, the formation of a provident society among the persons employed in gas companies. Most trades and handicrafts have, as he observes, long since established such societies, and the great wear and tear of human life in several of the processes of gas manufacture, render it especially desirable that such an institution should be established for the relief of the ailments from which the workmen suffer. We trust that some of the generous individuals whose names appeared in the subscription list for the relief of poor workmen, will unite to set on foot such a benevolent undertaking.

Register of New Patents.

2546.—MAURICE WESOLOWSKI, of Cincinnati, Ohio, U. S. A., merchant, for "*Improvements in the obtaining of light, and in the apparatus employed therein.*" Provisional protection only obtained. Dated Oct. 18, 1860.

This invention relates to a peculiar system or mode of obtaining an instantaneous light, suitable for lighting tapers or lamps, without the aid of matches, and consists in the employment of a small frictional electric machine, the disc or cylinder of which may be composed of glass, hard indiarubber, or other material, but hard indiarubber is preferred. The frictional rubber or pad is composed of cloth, or other suitable material, and is supplied with a peculiar amalgam. The rubber or pad may be applied to both sides of the disc, where it is desirable. The amalgam consists of one part, by weight, of spelter or zinc, one part of tin, and one-half part of quicksilver. The spelter or zinc is first melted, and the tin is added thereto, and well mixed together, after which the mercury is added to the mother mass. The whole is then poured on to an iron plate, where it is cooled, and subsequently reduced to powder in a mortar, and passed through a fine sieve. The current of electricity generated by the machine is conducted to a vessel containing a mixture of sulphuric alcohol and etheric oil, or other equally inflammable fluid, this vessel being insulated. A cotton or other wick in this liquid is, in connexion with a wood or other suitable electrode, carried by the cover of the vessel. Above the end of the electrode is a metal wire, or negative, for the purpose of obtaining the electric spark when the machine is operated.

In using this apparatus for the obtainment of an instantaneous light, it is simply necessary to impart a sharp turn to the disc or cylinder of the electric machine, whereupon the current generated thereby is conducted by a suitable conductor through the metal of the vessel, and is discharged from the metal socket which contains the electrode. This electrode being saturated with alcoholic sulphur and etheric spirit, is instantly ignited by the action of the electric spark, and remains ignited as long as required for obtaining a light for a taper or lamp.

2574.—Joseph Wadsworth, of Marple, in the co. of Chester, mechanic, and James Wadsworth, of Salford, Lancaster, machinist, for "*Improvements in gas-burners, and improved modes of manufacturing the same.*" Patent dated Oct. 22, 1860.

These improvements in gas-burners, so far as the same have reference to solid burners, consist in causing the internal cavity or canal of the stem-pipe or tube of the burner to terminate towards the apex of the burner in a small bulb, or enlargement of the cavity, from which bulb proceed the orifices or orifice at which the gas is ignited. The improvements, so far as they have reference to sheet-metal burners manufactured as hereinafter mentioned, consist in narrowing the pipe-stem or tube of the burner a little below the apex thereof, so as to form a neck or contracted passage, above which, and between it and the orifices or orifice through which the gas issues for consumption, the upper part of the burner is formed into a small bulb, or hollow chamber or cavity.

The improved modes of manufacturing gas-burners, consist in cutting the same, or the parts thereof, out of sheet-metal, and imparting the required configuration by stamping, compressing, or drawing with or through dies, matrices, or punches, and (generally, but not always) by the process, or operation known as knurling [or milling, the parts being finally united if formed separately, and the proper orifices made by drilling, or sawing, or punching and compressing. The improvements also consist in constructing burners partly by the means above indicated, and partly by ordinary modes, as for instance, by uniting a stem or tube, as in a common burner with a nipple, tip, or apex of stamped sheet-metal, or uniting a stem, pipe, or tube of sheet-metal with the ordinary nipple.

The claims are—

1. In solid gas-burners, the enlargement of the upper part of the cavity, or canal of the stem, pipe, or tube of the burners.

2. The formation of gas-burners by stamping, drawing, pressing, knurling or milling.

3. The formation of parts of gas-burners by means of stamping, drawing, pressing, knurling or milling.

2577.—John Henry Johnson, of 47, Lincoln's Inn Fields, London, and Glasgow, for "*Improvements in apparatus for measuring the flow of liquids, partly applicable to ordinary water-cisterns.*" Patent dated, Oct. 22, 1860.

This invention relates to a peculiar construction and arrangement of apparatus, whereby the flow, or amount of consumption of liquids is indicated in a simple and efficient manner, and consists as applied to a service or house system in so combining the feed, or supply-pipe of the cistern with the discharge-cock or pipe, that the opening of the one will effect the simultaneous closing of the other, and *vice versâ*. The level of the water in the cistern is by this means made to fall when the water is drawn off therefrom, and to rise again when the feed or supply is turned on, but in no case can the water be drawn off simultaneously with the inlet or supply of fresh water to the cistern.

This peculiar combination of the feed-pipe with the discharge-pipe is effected by means of a cock, with the body or shell of which both pipes open, but the plug of which is provided with corresponding apertures, or with a groove or channel so disposed that the opening of one orifice in the body of the cock will close the other, and *vice versâ*. The consequent alternate rising and falling of the level of the water in the cistern is made to impart a rotary motion to the spindle of a counter by the agency of a float inside the cistern and a counter-weight outside the float, the counter-weight being suspended from cords or chains which pass each over a pulley on the spindle above referred to. The pulley of the float is loose upon the spindle; but, when it rotates in one direction, it imparts a rotary motion to the spindle, by a system of palls and a ratchet-wheel, whilst, during its rotation in the contrary direction, the palls pass round the ratchet-wheel without influencing it, and consequently without actuating the counting mechanism, which may be of any convenient construction. The palls and ratchet may be so arranged as to come into action during the descent of the float, thereby showing the amount of liquid drawn off from the cistern, or during the ascent of the float, so as to show the amount of liquid supplied to the cistern. The upper part of the float may be made conical, so that when the cistern is nearly full it will rise and fit closely into an air-hole or vent in the lid or cover; and, by thus precluding the escape of the air, prevent the further influx of water therein, and the overflowing of the cistern. In order to prevent any derangement of the apparatus by the freezing of the water in the cistern, it is proposed to form a separate chamber or compartment in the bottom or sides of the cistern, which is to be kept supplied with warm water by pipes for that purpose. This arrangement is obviously applicable to all house or service-cisterns where the water therein is liable to be frozen in inclement weather.

The claim is for the general construction, arrangement, and combination of apparatus for measuring the flow of liquids, and regulating the supply of liquids to and from cisterns or reservoirs, as hereinbefore described.

2603.—William Mann, of Barnsbury, London, gas engineer, for "*Improvements in apparatuses for washing and condensing gas.*" Patent dated Oct. 25, 1860.

These improvements in apparatus for washing gas, consist in the employment of a syphon-tube, the lower part of which enters the vessel in which the washing is performed, known as a scrubber; the tube is then bent, and is turned at the extreme end. Through a box, in the centre of the cover of the scrubbing-vessel, is introduced a shaft, with a tray or grating connected to, and so as to revolve with it. This tray is charged with brick, pebbles, coke, or other like suitable material. A pulley is placed on the shaft, and, fitted on the lower part of the syphon-tube, is a rigger. A belt, passed round the pulley and rigger, imparts a rotary motion from the shaft to the tube. The top of the syphon-tube is furnished with a funnel, into which a continuous supply of water, or other washing liquid, is fed from a cistern or other source. Under the grating or tray, a supply of pebbles, coke, or other like material usually employed in scrubbers, and through which the gas is made to rise, is placed.

The improvements in apparatus for condensing gas, consist in surrounding the condensing-pipes ordinarily used in gas-works with a series of brushes or rubbers of cotton, or other like material, which are made to rise and fall up and down the pipes, between trays or troughs fixed at intervals on the pipes, and supplied with water, which is fed into the uppermost trough, the overflow from which enters the next below it, and so on, to the lowest trough. Each time the rubbers enter the troughs, they take a supply of water, and, in ascending and descending, pay it over the pipes. In cases where the condenser-pipes are horizontal, instead of vertical, the brushes or rubbers are made to revolve round the pipes, and are supplied with water from a trough underneath.

The patentee does not limit himself to the particular arrangements hereinbefore described; as, for example, in the apparatus for washing gas, two revolving tubes may be employed, each receiving a continuous supply of water, and both receivng motion from the central shaft; and, it is not necessary that the arm of the syphon-tube should receive a rotary motion, as a vibratory one will answer, the only difference being that the liquid will be led in semicircles instead of circles.

The claims are for—

1st. The arrangement of apparatus for washing gas, hereinbefore described, whereby continuous streams or showers of water, or other cleansing liquid, are maintained in the cleansing vessel or scrubber.

2nd. The improvements in apparatus for condensing gas, whereby the outer surfaces are moistened substantially in the manner hereinbefore described.

2616.—Richard Archibald Brooman, of 166, Fleet Street, London, patent agent, for "*Improvements in uniting water, gas, and other pipes and tubes.*" A communication. Provisional protection only obtained. Oct. 26, 1860.

This invention consists in uniting pipes and tubes by means of a collar free to slide along the tubes, and so formed as, after being brought over the abutting ends of any two pipes required to be joined, to leave a space between the inner surface of the collar and the pipes. The collar is made with an aperture, for the purpose of pouring in a mastick or cement, which on setting together with the collar, forms a hermetic joint.

The pipes are formed by preference with annular grooves at their ends, for giving a better hold to the mastick, or the ends of the pipes may be made with tongues or projections which enter grooves in the sliding-collar, the joints being made tight by cement or mastick applied in a heated or cold state. In some cases, the grooves are formed to permit of the collar being turned more or less to force the ends of the pipes together. Sheets or rings of indiarubber may be placed over the ends of the two pipes, to be joined and wrapped with wire, or cord, and then covered by the sliding-collar, mastick or cement being used at the ends of the collar.

APPLICATIONS FOR LETTERS PATENT.

115.—James Alexander Manning, Esq., of Inner Temple, London, for "*A mode or method of collecting ammonia from the waste gases arising from the combustion of coal.*" May 3, 1861.

1121.—G. Rydill, of Dewsbury, York, for "*A smoke-consumer and condenser, suitable for factories, railway-engines, steam-ships furnaces, brick-kilns, cinder-ovens, bakehouses, and other purposes.*" May 3, 1861.

1133.—Joseph Capron Tiffany, of New York, for "*A mode of promoting a more perfect combustion of fuel in furnaces, and the manner of effecting the same.*" May 6, 1861.

1152.—William Edward Gedge, of 11, Wellington Street, Strand, Middlesex, patent agent, for "*Improved means and apparatus for conducting or forcing the flow of water.*" A communication. May 7, 1861.

1177.—John Henry Johnson, of 47, Lincoln's Inn Fields, Middlesex, for "*Improvements in the decolouration and disinfection of liquids, and in the apparatus employed therein; which improvements are also applicable to the manufacture of drying oils.*" A communication. May 9, 1861.

1217.—William Clark, of 53, Chancery Lane, Middlesex, engineer, and patent agent, for "*The treatment of ammoniacal waters resulting from putrified urine, and from products extracted by the distillation of coal.*" A communication. May 13, 1861.

1233.—John Chedgey, of the Grove, Great Guildford Street, Southwark, engineer, for "*Improvements in the manufacture of glass rollers, plungers, and pipes; applicable to pumps and other uses.*" May 14, 1861.

1236.—William Clark, of 53, Chancery Lane, Middlesex, engineer, and patent agent, for "*Improvements in gas-regulators.*" A communication. May 15, 1861.

1237.—Edward Curtis Kemp, of Avon Place, Pershore Road, Birmingham, Warwick, agent, and Thomas Hall, of Basinghall Street, Leeds, York, gas engineer, for "*Improvements in gas and other lamps.*" May 15, 1861.

1248.—William Renwick Bowditch, clerk of St. Andrew's, Wakefield, York, for "*Improvements in safety and other lamps.*" May 16, 1861.

GRANTS OF PROVISIONAL PROTECTION.

894.—Charles Noyes Kernot, of Gloucester House, West Cowes, Isle of Wight, Southampton, gentleman, and Martin Dierich Rucker, of 116, Fenchurch Street, London, gentleman, for "*Improvements in the method of obtaining ammoniacal salts, and other valuable products, from liquors or substances containing ammonia, and for utilizing the residuum.*" April 11, 1861.

1051.—Ferdinand Charles Warlich, of 14, London Street, Fenchurch Street, London, for "*Improvements in preparing coal used in the manufacture of artificial fuel.*" April 26, 1861.

1052.—William Cowan, of Edinburgh, Mid-Lothian, gas-meter manufacturer, for "*Improvements in gas-meters.*" April 26, 1861.

1070.—William Edward Newton, of 66, Chancery Lane, London, for "*An improvement in gas-burners.*" A communication. April 27, 1861.

1087.—François Zacharie Roussin, of 29, Boulevard St. Martin, Paris, France, professor of chemistry, for "*Colouring matters derived from naphthamalina, cinitronaphthalina, and trinitronaphthalina, and application of such colouring matters to the dyeing and printing of fabrics.*" May 1, 1861.

1108.—Geo. Davies, of 1, Serle Street, Lincoln's Inn, Middesex, and 28,

St. Enoch's Square, Glasgow, civil engineer and patent agent, for "*Improvements in gas-burners.*" A communication. May 2, 1861.

1115.—James Alexander Manning, Esq., of Inner Temple, London, for "*A mode or method of collecting ammonia from the waste gases arising from the combustion of coal.*" May 3, 1861.

1121.—Geo. Ruydill, of Dewsbury, York, for "*A smoke-consumer and condenser for factories, railway-engines, steam-ships, furnaces, brick-kilns, cinder-ovens, bakehouses, and other purposes.*" May 4, 1861.

1152.—William Edward Gedge, of 11, Wellington Street, Strand, Middlesex, patent agent, for "*Improved means and apparatus for conducting or forcing the flow of water.*" A communication. May 7, 1861.

NOTICES TO PROCEED.

3168.—William Parry, of High Street, Deptford, Kent, potter, for "*Improvements in the manufacture of chimney-pots, pedestals, and such articles made from clay or plastic materials; and machinery for that purpose.*" Dec. 27, 1860.

6.—William Cooke, of Charing Cross, civil engineer, for "*Improvements in apparatus for ventilating.*" Jan. 2, 1861.

17.—Alfred Vincent Newton, of Patent Office, 66, Chancery Lane, Middlesex, mchanical draughtsman, for "*Improvements in the construction of air or gas-engines.*" A communication. Jan. 3, 1861.

212.—John Henry Johnson, of 47, Lincoln's Inn Fields, Middlesex, for "*Improvements in obtaining motive power from the expansion and compression of air, gas, or vapour, and in the machinery or apparatus employed therein.*" A communication. Jan. 26, 1861.

663.—John Ingham Taylor, of Manchester, Lancaster, civil and mechanical engineer, for "*Improvements in apparatus for the manufacture of gas from coal, oil, or oleaginous substances, and other purposes.*" March 16, 1861.

Parliamentary Intelligence.

HOUSE OF LORDS.

May 6, 1861.

The Neath Water Bill was read a second time, and committed.

The Staffordshire Potteries Water Bill was read a third time, with the amendments, amendments made, passed, and sent to the Commons.

May 7.

The Lord Chancellor informed the House, that the further Standing Orders applicable to the following Bills have been complied with:—The Sowerby Bridge Gas, the Middleton and Tonge Improvement, and the Liverpool Improvement Bills.

The Ryde Water Bill was committed.

The South Essex Water Bill was read a third time, passed, and sent to the Commons.

May 10.

The Victoria Docks Gas Bill was committed.

The Neath Water, and the Ryde Water Bills, were reported, with amendments.

The Dewsbury, Batley, and Heckmondwicke Water Bill was reported, without amendment.

The Whitworth Vale Gas, and the Weston-super-Mare Gas Bills, were read a third time, amendments made, passed, and sent to the Commons.

The Huddersfield Gas Bill was referred to a select committee, consisting of the Earl Graham (chairman), Viscount Falmouth, Viscount Hood, Lord Digby, and Lord Raglan, who will meet on Monday, May 13, at eleven o'clock.

May 13.

The Victoria Docks Gas Bill was reported, with an amendment.

The Clitheroe Gas Bill was returned from the Commons, agreed to, with amendments. The said amendments were considered, and agreed to.

A petition was presented against the Sowerby Bridge Gas Bill, from the Lancashire and Yorkshire Railway Company.

May 14.

The Elland Gas Bill was brought from the Commons, read a first time, and referred to the Examiners.

The Dewsbury, Batley, and Heckmondwicke Water Bill, was read a third time, and passed.

May 16.

The Burton-upon-Trent Water Bill, with the Examiners certificate relating thereto, was referred to the Standing Orders Committee.

The Huddersfield Gas Bill was reported from the select committee, with amendments.

The Sowerby Bridge Gas Bill was read a second time, and committed.

The Victoria Docks Gas Bill was read a third time, passed, and sent to the Commons.

The Neath Water, and the Ryde Water Bills, were read a third time, with amendments. The Bills were passed, and sent to the Commons.

May 17.

The Portsmouth Water, and the Clitheroe Gas Bills, received the Royal assent.

HOUSE OF COMMONS.

May 6, 1861.

The Examiner reported, that no Standing Orders, not previously inquired into, are applicable to the Wolverhampton New Water-Works Bill. The Bill was ordered to be read a second time.

The Fylde Water, and the Hastings Western Water Bills, were read a second time, and committed.

Three petitions were presented against the Parochial Assessments Bill.

The Sale of Gas Act.—Petitions were presented from the Chester Gas Company, the Montrose Gas Company, the Over Darwen Gas Company, and the Carlow Gas Company, for inquiry into the working thereof.

May 7.

The London Tramway and Dispatch Bill was reported—Preamble *not* proved.

The Clitheroe Gas Bill was considered, as amended, and ordered to be read a third time.

The Macclesfield Gas Bill was read a second time, and committed.

Four petitions were presented against the Parochial Assessments Bill.

The Sale of Gas Act.—A petition was presented from the Barnsley Gas Company, for inquiry into the working thereof.

May 8.

The Portsmouth Water Bill was read a third time, and passed.

The Elland Gas Bill was considered, as amended, amendment made, and the Bill ordered to be read a third time.

The Staffordshire Potteries Water Bill was read a first time, and referred to the Examiners.

The Sale of Gas Act.—A petition was presented from the Errol Gas Company, for inquiry into the working thereof.

May 9.

The Bolton Corporation Bill was reported.

A petition was presented against the Parochial Assessments Bill.

The Sale of Gas Act.—A petition was presented from the Cowes Gas Company, for inquiry into the working thereof.

May 10.

The Clitheroe Gas Bill was read a third time, and passed, with amendments.

The Sale of Gas Act.—A petition was presented from the Longwood Gas Company, for inquiry into the working thereof.

May 13.

The Examiner reported, that the Standing Orders, not previously inquired into, and which are applicable to the Grand Junction Water Bill, have been complied with. The Bill was ordered to be read a second time.

The Examiner reported, that no Standing Orders, not previously inquired into, are applicable to the Leigh District Gas Bill. The Bill was ordered to be read a second time.

The Dublin Corporation Water Bill was reported.

The Elland Gas Bill was read a third time, and passed.

The Wolverhampton New Water-Works Bill was read a second time, and committed.

A petition was presented against the Parochial Assessments Bill.

May 14.

The Haslingden Union Gas, and the Swansea Gas Bills, were reported, without amendment.

The Northampton Water, and the Uxbridge Gas Bills, were reported, with amendments.

The Weston-super-Mare Gas Bill was read a first time, and referred to the Examiners.

May 16.

The Stockport District Water Bill was reported.

A petition was presented against the Wolverhampton New Water-Works Bill, from the corporation of Wolverhampton and others, and 2 against the Parochial Assessments Bill.

May 17.

The Examiner reported, that the Standing Orders, not previously inquired into, with respect to the South Essex Water Bill, are not complied with. Referred to the select committee on Standing Orders.

The Examiner reported, that the Standing Orders, not previously inquired into, with respect to the Blackburn Water Bill, are complied with. The Bill was ordered to be read a second time.

The Haslingden Union Gas, and the Swansea Gas Bills, were read a third time, and passed.

The Whitworth Vale Gas Bill was read a first time, and referred to the Examiners.

Five petitions were presented against the Highways Bill; and 3 against the Parochial Assessments Bill.

The Sale of Gas Act.—Petitions were presented from the Cardiff Gas Company, the Belfast Gas Company, and the Leicester Gas Company, for inquiry into the working thereof.

HOUSE OF LORDS.

(*Before the Earl of* Eglinton, *Chairman, the Marquis of* Sligo, *Lord* Home, *Lord* Dynevor, *and Lord* Congleton.)

WOLVERHAMPTON NEW WATER-WORKS BILL.

Friday, April 19.

Sir W. Alexander and Mr. Clerk appeared for the promoters; Mr. Hope Scott, Q.C., Mr. Powell for the corporation of Wolverhampton; and Mr. Esplin for the Wolverhampton Old Water-Works Company, petitioners against the bill. There were petitions against the bill by the Bilston town commissioners, and by ratepayers, owners and occupiers, but no counsel appeared to support them.

Sir. W. Alexander said this was a bill to enable the Wolverhampton New Water Works Company to raise additional capital, and he would briefly state the circumstances under which the application was made. Prior to the year 1845, the inhabitants of Wolverhampton were wholly dependent for their supply of water upon wells and pumps, for though it was then a large and very populous town, no water-works had up to that time been established. In that year, a water company was incorporated, but the works executed under that Act proved totally abortive, and the inhabitants were really in no better position after they came into operation than they were before. One of the principal causes of the failure of those works was that when the promoters of the bill were before Parliament, they were opposed by the Staffordshire and Worcestershire Canal Company, who were apprehensive that, if their works were established near to the canal, the waters would be abstracted to their detriment. The consequence was, that the water company were obliged to erect their works at a place called Tettenhall, a distance of some miles from Wolverhampton, and, therefore, their supply was not at all what they expected it would be.

Disappointed in their first endeavour, the company obtained an additional Act in 1850; and, under the powers of that Act, works were established at Goldthorn Hill, a distance of two miles on the other side of Wolverhampton. The capital of the company under the first Act was £26,000 in shares, and a borrowing power of £8000. Under the second Act, they were authorized to raise £35,300 making the total capital of the company £69,300. Their operations, however, were still conducted very unsatisfactorily, their plans were not well devised, and in 1855, they applied for a new Act of Parliament, by which they asked to be authorized to go to a greater distance, namely, six miles, to seek for a supply of water for the town. The corporation of Wolverhampton at the same time applied to Parliament for an Act to confer on them similar powers, and during the same session a new company was originated, so that there were three rival schemes before the Legislature. The contest usual in such cases arose, and in the result the schemes of the corporation and of the old company were rejected, and an Act incorporating the new company was passed by Parliament. The new company, who were the promoters of the present bill, proposed to bring their supply of water from Cosford brook, a distance of eight miles from Wolverhampton, and the capital they were authorized to raise for the purpose consisted of £100,000 in shares, and £22,700 by borrowing. To prevent any rivalry in the town, they agreed to purchase the works of the old company by the payment of a guaranteed annual rent, or interest, on a capital expenditure of £46,800, and to indemnify them from a debenture debt of £17,300. In 1856, they obtained an Act of Parliament, authorizing the transfer of the works of the old company to them, on those terms. They subsequently satisfied the claims against them, and, up to the present time, they had continued to pay 4½ per cent. upon the capital of the old company. In carrying out their plans for the supply of Wolverhampton, they had worked all three stations—the Tettenhall, Goldthorn, and Cosford brook, and, upon the whole, had furnished to the town an abundant supply of good water. The whole of their capital had been expended upon these works, and they now sought by this bill for powers to raise £30,000 by new shares, and, for borrowing powers to the extent of £7500. To this alone the bill was confined, and the purposes to which the new capital would be applied, were alterations and improvements of their works which were rendered absolutely necessary to their efficiency. This being, therefore, a pure money bill, the clauses which related to the purchase of the Bilston works having been struck out, he was at a loss to understand on what ground it could be opposed. There were two petitions upon which appearances had been entered, the first of which was from the old water-works company; and it was rather a singular petition, for they alleged that they ought to be heard to object to their not getting 5 per cent. upon their capital. Now, what a mere money bill like this, which proposed to authorize the company to raise capital to be wholly laid out upon the works, can have to do with that, or how the petitioners could be thereby injuriously affected, he was at a loss to conceive. His learned friend, therefore, who appeared for the old water-works company, must not be surprised to hear him state that he should object altogether to his *locus standi* before the committee. The other petition was from the corporation of Wolverhampton, and he was equally at a loss to know what *locus standi* they could have against a bill of this kind. In their petition, which was a very long one, the corporation set out in detail most of the circumstances he had already stated to the committee; but, there was nothing in any of those circumstances which could justify their appearing against a bill which sought only the means of carrying out more effectually the scheme already sanctioned by Parliament. The promoters did not seek for additional powers to go into new districts, nor to take houses and lands belonging to the corporation, but simply to raise between £30,000 and £40,000 for the specific purposes of their existing Act. The corporation, feeling that their general allegation would not support their appearance, had introduced a clause into their petition, urging that the promoters of the bill should be required to introduce a clause to supply water to the town always under high pressure, so that the fire-plugs should be always filled, and that the service should be constant. But the corporation were aware that, by the Act of 1855, the company were exempted by special clause from complying with the ordinary system of giving a supply under high pressure. The 4th clause in that Act was to the effect that the water to be supplied from any pipe of the company need not be constantly laid on under pressure; and this clause was found in an Act, against which the corporation appeared, with a rival scheme, so that there was every probability that they were fully cognizant of it, and might have even been consenting parties to its introduction. According to the Water-Works Clauses Consolidation Act, the water was generally to be supplied under pressure; but here it was probable that, in consequence of the great elevation of the place, and the expense necessary to supply under that pressure, and also having reference to the mineral district through which the pipes passed, and the constant subsidence of the earth, the Legislature introduced this exceptional clause, by which the necessity for supplying under pressure was not required; and, indeed, in this particular case, it would be quite impossible to do it. But he submitted to the committee that, according to all parliamentary usage, on the introduction of a bill by which it was sought to raise new capital only for the carrying out of a scheme already sanctioned, the corporation had no right to ask the Legislature to repeal a clause inserted in an Act under the circumstances he had stated. His friends had mistaken their time and opportunity, and he should object to their being heard.

Mr. ESPLIN said he appeared for the old water company, and their case was this—their works were bought by the new company, and an Act of Parliament was passed sanctioning that arrangement. The terms of purchase were the payment of an annual interest upon the capital of the old company, commencing at 3 per cent., and advancing, with a condition which he should have to allude to, to 5 per cent. At present, it was 4½ per cent.; and the old company felt that, in the present state of things, they would be entitled, within a very short period, to the payment of the maximum dividend of 5 per cent. The condition of their receiving that dividend was the fact of the new company paying their own shareholders at a similar rate upon their entire capital. But, if that capital, which was now £100,000, was to be raised to £137,000, and the 5 per cent., to which the new company's shareholders were entitled, was to be reckoned on this increased sum, the terms of the agreement into which his clients had entered, would be altered to their disadvantage, and the time at which they would obtain their maximum dividend indefinitely postponed; especially, as by the proposed extension of the works, not only would the capital be increased, but the working expenses be much heavier. Under these circumstances, the terms of their security being altered, supposing the bill passed, the old company felt that they had a clear *locus standi*, and that this was the proper time for them to interfere. The bill, in its original shape, was one of a very different kind, as it authorized the buying of other works, which, in a greater and more material degree, affected the position of his clients. A great deal of the sting had been removed, but enough remained to justify his appearance and ask the committee to protect the agreement under which the old company disposed of their undertaking.

Sir W. ALEXANDER in reply said, if this argument should prevail, it would defer all enlargement of the works, and, in all probability, indefinitely postpone the payment of 5 per cent. to the shareholders of the old company. It was difficult to understand how the outlay of money upon a security could dimish its value. The natural result would be in the other direction, because the extension of the company's capabilities would increase the number of their customers, and thus add largely to the rental, out of which all dividends had to be paid.

Mr. HOPE SCOTT, on behalf of the corporation, maintained their right to be heard. One reason urged against their *locus standi* was, that the bill referred only to questions of capital; but he would remind the committee that that was not the form in which the bill was originally introduced, and it had been already decided that, by altering or striking out some of the clauses of a bill after its introduction, the promoters did not at all remove the *locus standi* of the petitioners. And even against the bill, as it at present appeared, he felt assured the committee would be of opinion that he had an indisputable right to be heard. As early as April, 1845, an Act was passed for the purpose of supplying Wolverhampton with water; that was the old company's first Act. In 1850, that Act was amended; but, even under the first Act, a constant supply of water, for the purpose of extinguishing fires, was required on the part of the company. There was, however, no provision for a constant supply to the inhabitants until the Act of 1850 was obtained. In the latter Act was incorporated the Water-Works Clauses Act of 1847, and, under that incorporated Act, a constant supply was provided for; and, in accordance therewith, the old company, whom he now represented, carried on their undertaking. In 1855, they had a scheme in Parliament for a further extension of their works. The new company were in Parliament at the same time, and the corporation of Wolverhampton were also promoting a bill. The committee of the House of Commons, to whom these bills were referred, came to the conclusion that the corporation scheme was the most desirable one.

Sir W. ALEXANDER objected that the facts were against this statement.

Mr. HOPE SCOTT read a clause from the Act which was passed in that year, providing for the purchase of the water-works by the corporation whenever they chose to require it on payment of 6 per cent. dividends to the shareholders upon the amount of their capital invested in the undertaking. This, he submitted, proved that the Legislature considered it right that the supply of water to the town should be in the hands of the local authorities. In 1856, the new company undertook the works of the old company, with a limitation of 6 per cent. upon the amount of their capital, and guaranteeing 4½ per cent. to the shareholders in the original undertaking. In the Act of 1855, a clause was introduced, which relieved the new company from giving a constant supply; the reason being, that their works were not at a level sufficient to afford it. But, the old company were required to furnish a constant supply, and did so; and the new company, in 1856, acquired all the rights, and therefore stood in the position, of the old company. They, however, simply denied, and were now endeavouring to reject, all the obligations which they then came under. They asserted that they were not bound to keep their pipes full of water, and they had actually had a judgment on technicalities in their favour. The petition of the corporation stated, and he was prepared to prove, that a fire recently took place in the town, and there was no water to be had, because the promoters of this bill denied that the obligations of the old company were binding on them, although they had taken a transfer of their powers and rights, and had obtained possession of their high-level reservoir. This was the present state of matters between the promoters and the corporation; and it was no answer for his learned friend to say, the company had reduced their bill to a mere money bill. The parties were now upon technical rights. The corporation had the power to call on the company to sell their undertaking at any moment; and, surely, with such an obligation hanging over them, they were not to be allowed to increase their capital as they pleased, and spend money no one knew how, on all of which money they were entitled to 6 per cent. whenever the transfer of the works to the corporation should take place.

Sir W. ALEXANDER said the works would be taken at a valuation.

Mr. HOPE SCOTT said that did not affect the matter; it was an alteration of that property which Parliament had declared they were entitled to buy, and which was to be taken at its then existing value. If this bill passed, the company would be empowered to swell their capital by the creation of new shares, for no legitimate object, but upon all of which capital the corporation must pay them 6 per cent. Under these circumstances, he submitted they had a right to be heard.

Sir W. ALEXANDER, in reply, said the corporation had no right to come before Parliament, to depreciate the value of the company's property, and then claim to buy the works at a less price than they would be able to do if this bill passed. The objection that the company were now under litigation was rather against than for the promoters; and he thought that Parliament would not sanction their endeavour to obtain a decision in this way upon a matter which was now *sub judice*.

The room was then cleared. After a short time, the doors were again opened.

The CHAIRMAN said: The committee are of opinion, that both the corporation and the old company have a *locus standi*.

J. F. Bateman, Esq., F.R.S., examined by Mr. CLERK.

I am engineer to the Wolverhampton Water-Works Company, and have been so since their formation in 1855, or immediately afterwards. I have had very much experience as an engineer, especially in connexion with water-works. The works executed by the new company have enabled them to give a good and abundant supply of water as far as the works extend. There was another company in existence at the time they were started, whose works were at Goldthorn Hill, and Tettenhall; but they were wholly insufficient. In 1856, the powers of the old company were transferred to the new, under an Act of Parliament; but the bulk of the water which we supply is brought from the river Wharve, near Willenhall, and that water has to be pumped up, first 200, and afterwards 300 feet, the district of Wolverhampton being a very high one. It is a mining district, and water is very difficult to obtain. The capital of this company is £100,000 in shares, and they have a borrowing power of £37,000, the whole of which has been expended in carrying out their Act. They still require a further sum of money for the purpose of completing their works, and making them more methodical in many respects, and to extend their supply to various other parts, by which the income of the company will be increased, and the wants of the public relieved. They will be obliged to construct an additional reservoir on Goldthorn Hill, and the whole of the proposed new capital will be required, within a few years, for the necessities of the district, as there is a large and increasing population. Under the Water-Works

Clauses Act of 1847, companies are bound to give a constant supply of water, unless exempted by their special Act. The special Act of this company, obtained in 1855, exempted them from giving a constant supply at high pressure. Where the level of the district is such as to require it, this exemption is frequently made. In the present case, it would entail a great loss of water, and involve a large expense to the company, if they had to supply water constantly at high pressure from the works at Wharve. A large portion of the district is of a mining character, and the ground is in a constant state of settlement. The pressure which we now give is, in some cases, very great; and the waste is considerable, much more so than is ordinarily the case with water companies. Every drop of water which is supplied has to be raised 500 feet, except the small quantity which we get from the old works. The principal mains are, at the present time, kept constantly charged with water; and, during eleven hours of every day, although we are not required to do so by the Act, we give a full and constant supply, and in case of fire, the water can be turned on at any moment. There is, therefore, no practical inconvenience from the exemption in the Act of 1855. I have no doubt there would be a considerable loss if we were compelled to supply constant high service.

Cross-examined by Mr. HOPE SCOTT: Our present supply of water is not a supply reaching the town by gravitation—it has to be pumped up, and is very expensive. I was not the engineer of the new company, when they proposed this scheme. The service reservoir was then near the top of the hill, between Cosford Bridge, where the works are situated, and Tettenhall, which is not so high as Goldthorn by about 150 feet. I was the engineer of the new company when they acquired the works of the old. Another reservoir was then constructed, and I recommended that that should be at Goldthorn Hill, on account of the elevation. At Tettenhall, I have constructed another reservoir for 10 or 11 million gallons of water. We propose to add an additional reservoir at Goldthorn. We could pump sufficient water for a constant supply. The old company did not not give a constant but a very limited supply, and over a very limited area. They were required to do so by their Act of Parliament; and I believe they did their best to effect that object. They had about 300,000 gallons of water a day from their wells; but we supply about 900,000 gallons a day over a much larger district. We supply Bilston principally; and at Willenhall we supply a few places. We have parliamentary powers to go into those townships, but another company have also power over a portion of the district. We have made an arrangement with the South Staffordshire Company, by which thay gave up that district to us, on condition of our paying £500 a year for a limited period only. As a general rule, a constant service is required of gravitation companies; but it depends in some cases whether they have powers of storeage, and, in many cases, as to the cost which parties would be put to in having to pump water to a great height. I do not, at the present moment, know of any water-works at a like elevation to Goldthorn Hill, which is excepted. The argument in favour of a constant supply is modified in this case by the fact of this being a mineral district. There is not much mineral at Bilston, or at Tettenhall. Wolverhampton is just on the edge of the coal-field. The ground between Goldthorn Hill and Wolverhampton is, for the most part, sound; but there is some broken ground. A portion of Wolverhampton lies over broken ground, but the main part is sound. We have had pipes drop three and four feet at one time in that district. I do not know how many houses were supplied by the old company, nor how many we supply.

By Mr. ESPLIN: The capital named in the first Act, was considered to be sufficient for the water supply of Wolverhampton. If we obtain new capital, our pipes will be extended in the broken district. There is more expense in keeping pipes in such a district in repair; but the capital invested there will be very remunerative. As the place is totally without water at present, it will be the most profitable investment we could make. The income upon pipe-laying is generally 10 per cent.

Re-examined by Mr. CLERK: The company by the provisions of the Act were not to supply Willenhall and Bilston with water, except under certain conditions. One provision was that, so long as the South Staffordshire Company should supply the respective townships, we were not to do so, or provided they did not exercise their right within the time specified by the Act. They were not prepared to execute their works so soon as we were, and we made an arrangement with them, and undertook their supply. The only reservoir the old company had was a small one on Goldthorn Hill, which was not sufficient to give a constant supply to Wolverhampton. It could only supply 150,000 or 180,000 gallons a day. We are now supplying 1 million or 1,100,000 per day including the supply from the old pumps. I cannot estimate the quantity of loss which we should sustain if we gave a constant supply, but it would be considerable. There is a great loss always in substituting a constant supply in a town accustomed to an intermittent supply. I recently ascertained the quantity of water supplied in Glasgow, and found that in the dead of the night they were drawing from Lake Katrine at the rate of 14 million gallons daily. We instituted a very strict examination, and found that from leaky taps alone the quantity of 7 million gallons was lost per day. I may state that in Chester, where we commenced at one time to give a constant supply, the waste was so great that we were obliged to discontinue it, and we now give twelve hours supply only. The waste was so great that the consumption increased from 300,000 to 900,000 gallons per day, and we have been enabled to bring it down by great care to 600,000. The exemption clause with reference to a constant supply is generally found in pumping schemes. The money proposed to be laid out at Wolverhampton for extension will be very remunerative. The ordinary rule with water companies is that they do not lay down pipes where it will not pay them 10 per cent. The cost of engine-pumps, and bringing water to a town, is a dead expense which brings in nothing until you get to the distributing apparatus. We have laid out all our dead expenditure, and have run short of money to carry our works to the district which will repay our outlay. There are no works in the present plan which were not contemplated originally.

By the CHAIRMAN: The supply we give to the town is for eleven hours in the day. During the rest of the twenty-four hours, the principal mains, which ramify through the chief parts of the district, are charged with water. and the company's office is situated in a very convenient place, near the centre of the town, so that in case of fire a communication could be instantly conveyed to them, and arrangements made to turn on a supply. I have no doubt the water might be in the pipes sooner than the fire-engines could be brought to the spot, so that the difference between a constant, and the present supply would be of no practical inconvenience.

Charles Tomlinson, Esq., examined by Mr. CLERK.

I am the secretary of the new water-works company. We keep men on the companys' premises night and day for the purpose of attending to fires. I have tested the quantity of water lost by constant service between six at night and six in the morning, The first test was from the 14th to the 20th of November, 1858, and the quantity lost was 228,000 gallons in one night. The next test was for fifty days, from the 28th November, 1858, to the 15th January, 1859, and the quantity lost was 137,680 gallons in one night.

Cross-examined by Mr. HOPE SCOTT: That was the whole quantity consumed from six in the evening to six in the morning. I have made a comparison between the quantity used day and night when under pressure, and when turned off at six in the evening, and found that the quantity used when the water was under pressure day and night, was 211,000 gallons more than when turned off at six in the evening. The whole of the water in Wolverhampton has to be pumped. The average expense to the company, during 1860, for every 1000 gallons was 1½d., that is for engineers, wages, stores, and slack. Supposing that there was that average loss of water which I have referred to, during the whole year, the loss to the company would be about £500 or £600. In the greater part of the town, we can get a supply at night after the water is turned off, by pipe pressure. The estimated cost of 1½ per 1000 gallons is for labour and coals only. We sell the water at 5d. and 6d. up to 1s. per 1000 gallons. The latter price is for water supplied for other than domestic purposes, which is supplied by meterage. [Witness was cross-examined at some length as to a want of water in the case of a recent fire in the town, which he denied to be the fact.] We supply about 7000 houses in Wolverhampton, which, averaging five people to each house, give a population of 35,000 supplied by us. The total population of the town is 260,000. The old company supplied about 4000 houses, The average consumption is about 65 gallons per customer, or about 13 or 14 gallons per head. The evidence given by the old company was, that they, with their constant supply, gave 17 gallons per customer. There was no complaint of the conduct of the company, excepting in reference to this one fire. I know that there is a petition against this bill, and I believe it is signed by 5000 people. The gross receipts of the company for 1860, were about £10,000 in the entire district.

Re-examined by Mr. CLERK: The fire referred to took place on a spot where the mains are constantly kept charged. It would not take more than ten minutes to get the water into any part of the district.

This closed the case of the promoters.

Mr. *Barry*, examined by Mr. POWELL.

I am a magistrate of the borough, and a large manufacturer of japan works, employing from 200 to 300 hands, and have a considerable amount of combustible material upon my premises. There are also large manufactories of a similar kind in the immediate neighbourhood, where a great number of hands are employed. In my judgment, the town is not sufficiently supplied with water. My tenants have frequently complained to me that, if they or their families require water, as is sometimes the case in sickness, during the night, they are obliged to go about begging for it. Originally, I took water from the old company for my engines. When I first took it, the supply was constant; afterwards, I found it was not supplied regularly, and I discontinued it. With reference to boilers, &c., an intermittent supply of water is very dangerous. I was told that I might have a constant supply if I would sink a tank; but I found it better to sink a well, and do without it; and several persons in my neighbourhood have done the same. The complaints throughout Wolverhampton of deficiency of water are general. If a constant supply was furnished by this company, I have no doubt their consumption would be largely increased. I am the owner of sixteen houses in Canal Street, which are supplied by the company, but my tenants are not satisfied; they complain that, after six in the evening, they cannot get any water. I remember a public meeting of the inhabitants on this subject, which was numerously and respectably attended. A resolution was adopted, with reference to the supply of water to the town, and a petition to Parliament got up against this bill, which has been signed by 5400 inhabitants.

Cross-examined by Mr. CLERK: I cannot say whether the mains are constantly charged where I live, as I do not take the company's water for my own use. I had something to do with the corporation bill in 1855. That was an unsuccessful scheme. We opposed the bill of the new company on that occasion; but I was not aware that Parliament exempted them from the necessity of giving a constant supply. I was mayor of Wolverhampton at the time, but I was not conversant with all the clauses of the bill. I knew the corporation wanted to have the supply in their own hands, and I was on the committee appointed to manage their bill; but we left the engineer to attend to these details. I do not recollect whether there were any complaints against the company until after the summons was taken out against them last autumn. The meeting at which the petition was signed was a meeting of the inhabitants of the borough, and about 300 persons were present. I cannot say whether the corporation sent round to get signatures. Many persons signed it in the room, but I believe afterwards it was sent round. At the time we proposed our bill, in 1855, and for some time previously, I believe the old company had not been giving a constant supply.

Re-examined by Mr. POWELL: The signatures to the requisition to call the meeting comprised the principal merchants and manufacturers, &c. of Wolverhampton. The fire last autumn was close to the company's office, but the premises were quite consumed, and the damage was about £500. The complaints of the want of a regular supply at Wolverhampton have been numerous for many years, and especially with reference to fires.

MONDAY, APRIL 22.

Mr. *James Walker*, examined by Mr. POWELL.

I am a town councillor of Wolverhampton, and the manager of two building societies in the town. I am also the owner of a foundry and engineering establishment in the same place. The area of the borough is 3440 acres, of which 569 are upon the coal-field. The number of houses in the borough is 1270, of which 500 only are upon the coal-field; or 862 buildings of all descriptions, including huts, hovels, and stables. The population of the borough is assumed to be about 70,000, which is an increase of 20,000 since the last census. There are four flour-mills, six chemical works, twenty iron-foundries, fourteen japan-works, seven saw-mills and timber-yards, four rope-walks; eight varnish, vitriol, and tallow-factories; one naphtha-work, two gas-works, and four coach-factories in the town. These factories employ a large number of hands, and there are many small ones in addition. They are all within the limited area which I have given as the borough proper. The men in some of the iron and other works are employed during the night, and, as a practical man, I know that it is very necessary they should have a good supply of water at all times. The men must have either water or beer, and the masters prefer that they should have water, and, in many cases, go to considerable expense to furnish them with a supply. Oil, naphtha, gunpowder, and other inflammable materials are used in the factories of the town. The varnish and vitriol-works are in the centre of the town. I do not know the number of fire-cocks belonging to the local board of health. At my foundry, we are not supplied with water by the company, in consequence of their not furnish-

ing a supply for a sufficient number of hours, for the purpose of the steam-engine. I have, in consequence, constructed a cistern, and sunk a well. I was one of the oldest customers of the old company. I am the owner or manager of a great number of houses, none of which, except the old ones, are supplied with water by this company. I find the supply, not being constant, is a very great injury to the inhabitants. Many of the poor people of Wolverhampton go to work early in the morning, and want water for their breakfasts; and, when they come home at night, the women want water for washing their clothes, but they are not able to obtain it, as they leave home before the water is turned on, and do not return until it is turned off. The pipes were originally laid for a constant supply by the old company, and, in consequence, there are scarcely any cisterns in Wolverhampton. There are a great number of complaints as to the present mode of supply, and I have no doubt many more persons would take the water if it was on constantly. I have told the company so repeatedly. I know that many manufacturers have ceased to take the company's water, in consequence of the supply being intermittent. There are a great many steam-boilers in the town, and it is highly important that there should be a constant supply of water to them. The building societies with which I am connected make advances to the extent of about £10,000 a year, and we invariably find that persons who borrow money for building, prefer to sink wells, instead of taking water from the company, and putting up cisterns. I was at the meeting last February, which was called on the requisition of 2000 burgesses; it was an influential meeting; the resolutions adopted were passed unanimously, and the petition to their lordships was the result. I think, if there were a change from an intermittent to a constant supply, and proper notice were given to the inhabitants, the waste of water would be very trifling. One of the causes of the waste, in the first instance, would arise from persons going in the evening for water, and, finding none, might carelessly leave the tap unturned; and the water being laid on before the morning, would, of course, run to waste. Before the water companies were established, there were a number of pumps and wells in the town, which were afterwards allowed to go out of repair; so that, in case of fire, the inhabitants practically depend upon the supply from the company, and, in that state of things, the intermittent service is a matter of serious complaint and inconvenience.

Cross-examined by Mr. CLERK: I am a member of the corporation, and one of the committee appointed to oppose the bill. I am aware that the Act of Parliament at present regulating the company, was passed in 1855, but I was not a member of the corporation then. The limits of the borough have not altered since that time. I do not know what the powers of the company are with reference to supplying a district beyond the municipal boundary. The borough of Wolverhampton is not co-extensive with the parish; the latter is much larger. My desire is to see a constant supply laid on to Wolverhampton proper; I have nothing to do with the district beyond it. The majority of the manufactories are not situated on the banks of the canal, but some of the iron-works are. The whole of the chemical works are not near the canal; one of them is situated close to the two banks in the centre of the town. Several of them are on the canal. I cannot say whether they were all existing in Wolverhampton in 1855; there were all the kinds of manufactories which I have spoken of there, then. I believe, if the women want water before seven in the morning, they cannot get it unless they fill large jugs and pans over night. In my foundry, I have a pump; I cannot tell how long I have had it; it may be three or four years; it has been there ever since the foundry was erected. For domestic purposes, I use the company's water, and I should have it for the use of the engine-house if there were a constant supply.

Re-examined by Mr. POWELL: This pump would not be necessary if I could obtain a constant supply from the company. The bulk of the chemical works are in the centre of the borough.

Mr. *Henry Banks*, examined by Mr. HOPE SCOTT.

I am an ironmonger, carrying on business in Dudley Street, Wolverhampton. I have been in business in Wolverhampton eleven years, but I have known it all my life. My premises are rated at £120 a year, and I depend exclusively for my supply of water upon this company. When I first took water from the old company, we had not a constant supply, and I found it necessary to construct a cistern. At first, the company supplied us very irregularly; and, when the works were transferred to the new company, I found an improvement in that respect: but we were left without any supply at night, which frequently caused inconvenience. I have often complained to the turncock, but I have not been to the company's office on the subject, as I did not think I should get any redress. At the time the new company took the works, I was led to understand that, when they got into proper order, we should have a constant supply. I think it is very necessary we should have it in case a fire should occur. I keep turpentine, resin, pitch, oil, and gunpowder on my premises. There was a fire in my shop recently, during the night, and I found that I could not obtain a supply from the main. I was, consequently, obliged to get a supply from my soft-water cistern. If I had not had that water immediately at hand, my premises, I think, would have been burned down, as one pailful of water at that moment was worth a hundred soon afterwards. This fire took place immediately over the cellar where my stock of inflammable things is kept. Dudley Street is very narrow, densely populated, and full of shops. I agree with the other witnesses that many old wells have been allowed to go out of repair, because the owners expected to obtain a constant supply; but there are a great many new wells being sunk.

Cross-examined by Mr. CLERK: My cistern is frequently filled now, and it might be filled constantly. The fire at my house was not extinguished by water from that cistern, because the soft water was more convenient. I do not think the cistern was filled at that time.

Captain H. Seagrave, examined by Mr. POWELL.

I am the chief constable of the borough; and the fire brigade is under my control. All fires are officially reported to me, and it is my duty to attend them. There have been fifty-one fires in the borough since I was appointed in 1857. [Witness was examined at some length in reference to several fires, and stated that there was a scarcity of water on each occasion.] The fire-plugs, I believe, are under the control of the board of health, and I apprehend they are kept in proper order. As the result of my experience in the borough, I am of opinion that there is not sufficient protection afforded to the inhabitants in case of fire.

Cross-examined by Mr. CLERK: I am not aware that the corporation have the care of the keys of the fire-plugs. We have some keys, but we are not allowed to use them. We have no turncock attached to the brigade, and those in the companies employ are not under my orders. I cannot say whether the keys were given to us by the water company when the plugs were erected. When a fire occurs, we send up to the water company in the first instance.

Mr. *Thomas Butler*, examined by Mr. POWELL.

I am inspector of the fire brigade at Wolverhampton, and have been connected with it about ten years. From my experience, I say that there is no a sufficient supply of water at night in case of fire. [This witness was examined and cross-examined at some length respecting the fires deposed to by Captain Seagrave.]

Mr. *Edward B. Martin*, examined by Mr. POWELL.

I am the engineer and lessee of the Stourbridge Water-Works, which are under my management. I was for some years engaged as assistant to my brother, who was resident engineer to the old company at Wolverhampton; and I afterwards succeeded him in that office. I am well acquainted with the works of the old and the new companies. The original works at Wolverhampton consisted of a pumping-station at Tettenhall, with mains in the principal streets of the town. The water was then derived from three shafts sunk in the red sand-stone. There were two engines at Tettenhall, which lifted the water over a stand-pipe 180 feet high, from whence it flowed into the town by gravitation. There was, therefore, a constant pressure of at least 100 feet head at the highest part of the town. There were communication-pipes to the houses from service-pipes laid parallel to the mains, so the supply of water for domestic purposes could be shut off; and the mains were constantly charged in case of fire. That state of things existed from 1847 to 1849; but the system of intermittent supply to the houses did not give satisfaction during that period, and in 1850 it was changed to a constant supply. In 1851, there was a high-service reservoir established on Goldthorn Hill, capable of holding 1½ million gallons. It was capable of being supplied from the Tettenhall works, and gave about 75 feet head at the highest part of the town. In 1852, another pumping station was erected near the reservoir, and the water was lifted into the reservoir by an engine; and the quantity supplied from the two stations was between 300,000 and 400,000 gallons per day. I recollect the period when these works were transferred to the new company. Since then, a third station has been erected at Cosford, about 6½ miles from Tettenhall. In my judgment, as a practical engineer, there is abundance of water to supply Wolverhampton upon the constant-pressure system. The Stourbridge Water-Works are about ten miles from Wolverhampton; and, I adopt the constant system of supply there. Bilston township, which it was originally proposed by this bill to supply, is entirely a mining district; but Wolverhampton itself is but partially so. In my judgment, there is no difficulty in supplying the borough on the constant system as economically as upon the present intermittent system, while it would be much more advantageous to the population. From my experience, I know that there is less waste on the constant system than the intermittent. The waste by the latter chiefly arises from taps being left open. When this company made the change, by way of experiment, full notice ought to have been given to the inhabitants, otherwise all the taps would be kept running during the night and until discovered in the morning. If is easier to maintain the pipes and mains in proper order on the constant system, because leakage is discovered directly it arises; whereas by the intermittent system it may go on for some time without being observed. It is also safer, the water is better, and the pipes are less disturbed, while the whole pressure is available at any moment in any direction, in case of fire. Water is sometimes surreptitiously obtained in the intermittent system, but connexions cannot be made at all when the pressure is on. The scheme for raising the water, authorized by the Act of Parliament, containing a restrictive clause, was a pumping scheme, without a high-service reservoir, and by which the pressure would be more difficult to maintain in the town; but, since the introduction of that clause, the company have obtained a high-service reservoir. At the time of that Act of Parliament passing, the old company were keeping their mains constantly charged; so that the town had always a supply in case of fire; but, since the two companies have amalgamated, that has not been done.

Cross-examined by Mr. CLERK: In 1855, I was one of the engineers of the old company, but I was not here giving evidence on behalf of their scheme. The new company were to pump from Cosford Brook, nine miles from Wolverhampton, to a reservoir at Kingswood. They there re-pumped it over a stand-pipe, and supplied the town from the pressure thus obtained. They pump to Tettenhall now, and then re-pump to Goldthorn Hill, which is about 450 feet high. At Stourbridge, we pump 150 feet. The cost of pumping 1000 gallons of water to that height is 2d. At Stourbridge, some of our mains run through the mining district, where there is actual mining beneath them. Our distributing-mains go through the district called the Lye Clay Mine. The ground about Stourbridge, where our pipes are, has sunk very much. We have fire-plugs, belonging to the company; not to the corporation. We have not been called on to supply them to the district. When I was engineer to the old company, at Wolverhampton, we were not originally obliged to give a constant supply; but we were placed under obligations to do it by the Act of 1850, and we did so for two years. We supplied about 4000 houses during that time; and the total quantity of water was between 300,000 and 400,000 gallons per day. Those works were gradually diminished in quantity since they commenced. I have heard it stated that the supply of water is turned on for eleven hours every day. This is not a proper intermittent supply, in the usual sense of the term. It is not a general rule to give a constant supply where the company have to pump the water.

Re-examined by Mr. POWELL: Where there is not a constant supply, it is necessary there should be cisterns provided in all the houses; but Wolverhampton having been prepared for a constant supply, cisterns were not insisted upon. I am acquainted with the regulations of the old company; one of them was, that no cisterns for the storeage of water for domestic use would be required, in consequence of their giving a constant supply. Those rules were, I presume, adopted by the new company, as lessees of the old. I am not aware of any other regulations.

Mr. POWELL: The first regulation was, that the supply of water for all purposes will be constantly laid on, both day and night, so that each of the company's customers will be enabled to draw water fresh from the pipes.

Mr. CLERK: That was the old company.

The Marquis of SLIGO: We understood at the first that the new company was specifically exempted from the necessity of giving a constant supply.

Mr. POWELL: That was in their first Act; but, in the agreement Act, the obligations of the old company were transmitted to the new.

Thomas Hawksley, Esq., C.E., examined by Mr. POWELL.

I have had great experience in the construction of water-works, and as the result I approve of the system of a constant supply, because it is more beneficial both to the suppliers and consumers. As a rule, there is less waste on the constant system than on the intermittent. Of course, when the constant system is first adopted, where there has been an intermittent supply, the waste for a short time is enormous, but after a while that is effectually checked, and in all cases with which I am acquainted the intermittent service requires more water than the constant; that is to say, a deficient intermittent service. An experiment such as has been spoken of, would not be a fair one as to the waste occasioned by a constant supply.

I have had many occasions to change from the one system to the other, and in all cases I have found the consumption has been considerably diminished. I am aware that the general course of legislation is in favour of the constant supply system, both in pumping and gravitation works. I have made a great many pumping-works, and in all of them the constant system is in operation. It is easier to give a constant supply with pumping-works, because you can always regulate the quantity of water transmitted to the population, and are in no difficulty in keeping a supply in the reservoirs. With regard to gravitation works, it frequently happens that in dry seasons you are in doubt whether you can tide over the time, whereas with the pumping system you are never in that difficulty at all.

The CHAIRMAN: I presume the pumping system is more expensive?

Witness: No my lord, the gravitation system is the more expensive. Taking the average of all gravitation works, they cost from £2. 5s. to £2. 10s. per head upon the population, whereas the pumping system does not exceed from £1 to £1. 5s. per head. Though it is a little more expensive in regard to coal, there is a great saving as respects interest upon capital, and pumping-works are very decidedly the cheaper of the two. There are some exceptional cases. At Whitehaven, for instance, they had to construct an enormous service reservoir, and to buy up expensive water-works; but, as a general rule, the pumping system is very much cheaper than gravitation.

By Mr. POWELL: Dundee, Edinburgh, Glasgow, Whitehaven, Newcastle Manchester, Leicester, Sheffield, Liverpool, and Leeds, are all gravitation works, furnishing a constant supply; at Sunderland, Shields, Durham, Stockton, Nottingham, Birmingham, and South Staffordshire, it is a mixed system, about seven-tenths being gravitation; and at Derby, Coventry, Hull, St. Helen's, and many other towns, there are pumping-works, on the constant system. These are only instances of a number of places. In mountainous districts, the gravitation system is generally resorted to; and, in the flatter districts of the country, the pumping system. In my judgment, the constant system is somewhat the cheapest; there are fewer turn-cocks required, and the management is much simpler. The cost is about ¼d. per 1000 gallons for every 100 feet they lift. With the intermittent system, every consumer of water has, in fact, to provide his own gravitation cistern. In the case of fire, unless the supply of water is at hand immediately, it is impossible to extinguish it. The great utility of the application of water to fire, must be before the building becomes so heated as to generate gas. If that is not done, all that remains is to prevent the fire spreading to surrounding houses. I do not believe there is any saving effected to a company by the intermittent system of supply. Take the large towns of Sunderland and South Shields. There is a population there of 130,000, and the works extend 14 miles in length—a large portion of the mains being in the coal-fields. The consumption is from 13 to 14 gallons per head per diem upon the constant system, including all the water supplied for manufacturing and trade purposes, although there is an unlimited supply over the whole 14 miles. At Nottingham, including the quantity used for trade and manufacturing purposes, we consume 18 gallons per head a day. The restriction of water, under the intermittent system, is, in my opinion, prejudicial to health, because it leads to the necessity of storing the water in domestic vessels, so that it is not always fresh when used. The existence of the coal-fields in this neighbourhood does not make any difference as to which system should be adopted. All the great water-supply systems in England are close to the coal-fields, and the water is delivered into the towns across them. At Newcastle, the mains come for many miles across the coal-fields, and the same at Sunderland, Shields, and Bolton. At Liverpool, the largest water-main in the world passes for many miles across the coal-field, and the coal is actually brought from under it in many places. The effect is that frequently the joints of the pipes are drawn down with the sinking of the ground, and they have to be set up again; the pipes are not broken, and the supply goes on just as usual. There is no practical difficulty in dealing with the pipes, under these circumstances. I am acquainted with the works at Wolverhampton, and know that there are not many mains on the coal-fields—all the works are upon firm ground. In my judgment, the present works in possession of the company are sufficient for the supply of the town; and I think their revenue would be largely increased by the adoption of the constant system. I heard Mr. Bateman's evidence to the effect that at Glasgow the waste goes on at the rate of 14 million gallons; but "at the rate" is a very different thing to the absolute quantity wasted. I know many cases where the introduction of the constant supply has been attended with valuable results, the most conclusive of which is that, where the company have attended to their business, it has been found the most economical. Of course, if a company is loosely conducted, or where, as with some companies it is the case, they go to the expense of pumping water, rather than pay for extra supervision, there is a considerably greater consumption; but, where there is good management, that is never the case. I do not know whether, as a matter of foresight, this company may require more capital. A prudent company will always make provision for the prospective increase of their district. I do not know whether their present distributive power is sufficient for their purpose. I have heard something of a proposed increase of reservoir room at Goldthorn Hill; but I know that a reservoir, which will hold a day's supply, will keep the company in constant operation. At Nottingham, which is a very large place, we have not more than one day's supply in the reservoir; and for thirty years the supply has not been off for a single day. In pumping-works, you only require a service reservoir as a regulator. It is the fly-wheel to the engine; it is to regulate the unequal draught, because the pumps are raising at one moment more than the town is taking, at another the mains are delivering more than the engine is supplying. I think, in actual lift, the difference between the old and new company's supply at Wolverhampton is 150 feet; but, in effect, including the allowance for friction, it is 200 feet; but that is only on a portion of the water. That would make a difference of one ¼d. per 1000 gallons on all the water transmitted from the remote station; but, as half the water is got at the other two stations, it only makes a ¼d. difference between one lift and another.

Mr. POWELL: There was an exception in the Act of 1855—was that scheme a pumping one?

Witness: It was a mixed scheme. The company had no service reservoir, but employed a stand-pipe. The new company were better advised, and altered their scheme. I presume that the necessity which led to the introduction of that clause does not now exist. The new company have the same facility for giving a constant supply that the old company had, as they have the old company's works in addition to their own.

Mr. POWELL: Do you know of any company having so commanding a reservoir, where a constant supply is not given?

Witness: Oh, yes; the metropolis.

Mr. POWELL: Is it a fact that, where there is a commanding reservoir, there is usually a constant supply?

Witness: It is the fact, but I do not know whether it depends upon that. Applying my judgment to this case, I think that Wolverhampton should have a constant supply during the day and night. There is no reason, that I am aware of, why it should be exempted from the general law.

Cross-examined by Mr. CLERK: The cost of pumping is not the reason why there is not a constant supply of water in the metropolis. A great many engineers in the metropolis are in favour of it; but the reason of its non-introduction is of a very different character. It is in consequence of the very bad system of supply which has so long prevailed, and which there are no means of correcting. The water-butts of the consumers are all on the ground-floor; and, in the majority of instances, are without ball-cocks, as they are constantly liable to be stolen; while the cisterns in the upper part of premises are all provided with overflows, for the system of intermittent supply. The consequence is, that no assignable quantity of water, without an alteration in the present system or arrangement, would suffice to supply the metropolis. The town of Birmingham is supplied by a company. The system there is that of a constant supply, it having been changed from the intermittent. I do not know whether the company were bound to do it, but I know that they have found it to their advantage. The engineer of that company told me that they had resorted to the system with great success. At Chester, they give a lengthened intermittent supply. I do not know why they should not give a constant supply, as it is a very easy thing to do there. I was engaged by the Wolverhampton old company, more than eight years ago, to advise them, and I recommended them to adopt the constant supply, which they did, as long as their resources would enable them to continue it. It was not abandoned because of the increased consumption of water per head of population; but because the town rapidly increased, and they had to spread their limited quantity of water over a greater surface—they had not sufficient water to meet the demands of the place. One farthing per 1000 gallons is the general cost of pumping water, where coal is cheap. I am not usually in the habit of putting it at one halfpenny per 1000 gallons, for pumping expenses merely. I have not often said that that was the cost, except in places where coal is very dear. I have laid mains in a district like Wolverhampton. At Liverpool, the distributing-mains are laid in the new red sandstone, as it is here. There is a great liability to corrosion where there are ashes on the ground. This is the case in some parts of Wolverhampton, but not in all. The district to the right of the fault has not a large population in it. There is a large population towards Bilston—that is, in the coal-field. Towards Willenhall and Wednesfield, within the limits of the company's supply, the population is not so great. I have not said that the company do not want more capital for new works; but, that, as regards the supply to Wolverhampton proper, I did not think it was necessary, except for distributing apparatus. If they require ten miles of additional pipes for that supply, the cost would be about £5500.

Re-examined by Mr. POWELL: None of the special reasons for not giving a constant supply to the metropolis apply to Wolverhampton. In many large manufacturing towns, it is common to have ashes laid under the stones, and the pipes laid in them decay rapidly; but, I should think that would not apply to the largest part of Wolverhampton.

Mr. HOPE SCOTT summed up the evidence for the corporation. He said the case before their lordships seemed to be a very simple one, and led, as he thought, to but one conclusion—viz., that some relief should be given to the inhabitants and corporation of Wolverhampton, and proper provision be put into the bill on the subject of a constant supply under pressure. The town of Wolverhampton was composed of a collection of some 70,000 people; it was the centre of very important manufactures and works connected with minerals; and, it was peculiar in this respect, that a portion of the manufactures carried on there involved the use of very inflammable materials. It really seemed too late in the day to urge with any degree of seriousness that, a town so circumstanced ought to have an abundant provision for the extinguishing of fires. One would have thought it was a self-evident proposition which could hardly admit of an attempt at denial. But, beyond that, it was a general principle embodied by Parliament in the Water-Works Clauses Act—that, a constant supply should be given to the poorer classes of the inhabitants of towns whenever that supply could by possibility be given. With regard to the formal proposition, the company could not deny that a constant supply ought to be afforded in case of fire; but, they asserted that they had given it; while, with reference to the wants of the poorer classes, it seemed to be admitted that the company could meet their wants, but that they objected to the cost it would involve upon them. The position of affairs was therefore this, that in a town of 70,000 inhabitants, a water company, which had obtained an entire monopoly, came before Parliament and asserted that they could not furnish a constant supply because of the cost, or they would not unless compelled to do so. What made this case peculiarly hard was the fact disclosed in the history of the circumstances under which the monopoly of the company was acquired. The committee had heard in evidence that the old company, under their Act obtained in 1845, were compelled to keep up an adequate supply of water under pressure, for the purpose of extinguishing fires; and under their Act of 1850, in which the Water-Works Clauses Act was incorporated, that obligation was extended to the whole district. In 1855, the new company promoted a bill in competition with the bill of the corporation, which bill was sanctioned by the Legislature but the rights of the corporation were so far acknowleged by Parliament, that provision was made in that bill for the transfer of the water-works to them, under certain circumstances. In 1856, the new company made a bargain with the old company, and acquired their works. The latter company, as he had remarked, were under obligations to give a constant supply under pressure, but their means of doing so were inadequate. The new company coming to Parliament, in 1855, before they had acquired the works of the old company, proposed a scheme which did not involve a high-level reservoir; and, consequently, a clause was put into their Act, exempting them from a constant service, because they had not sufficient elevation in their works to give it. But the corporation and inhabitants of Wolverhampton, in 1855, were in this position: they had two companies in the field, one of which was under obligation to give a constant service under pressure, and the other was not; the one having a comparatively limited supply of water, and the other a large one. Still, they were safe to this extent—that, within the limits of supply, they had it under pressure. The new company having obtained the works of the old company, promoted a bill in Parliament, in 1856, for the purpose of consolidating the two undertakings. It might be said that the corporation of Wolverhampton should have been more vigilant on that occasion; but it appeared to be the fact that the whole of the inhabitants were then under the thorough conviction that, notwithstanding the transfer, the obligations of the old company still survived. With this conviction, they had more recently brought the matter before a court of justice. The company, it was true, had obtained a decision in their favour, on technical grounds; and the question was now before the superior courts, whether the old company's

obligations to maintain a constant supply of water, in case of fire. was binding upon the new. His learned friend, Sir W. Alexander, had treated this as a *lis pendens*, and urged that, on that ground, the committee should not interfere. But he (Mr. Hope Scott) had known several cases, of late years, in which Parliament had stepped in to settle points of this kind, knowing best what its own intentions and views were; and, if it intended or thought it ought to express that a particular function ought to be undertaken, no *lis pendens* was ever allowed to prevail, so as to prevent justice being done. What was the case here? It was contended that the obligations of the old company were at an end in this respect, and that the new company were exempted by a special clause in their Act from giving a constant supply. But, could it have been the intention of Parliament, in 1856, by giving legislative sanction to the transfer of the old works to the new company, that the town of Wolverhampton should lose its right to have a constant supply of water? He would challenge his learned friend to produce any proof of the kind. He would undertake to say that, if, in 1856, the corporation had had doubts upon the point, and had appeared before Parliament, those doubts would have been at once removed, and Parliament would have made that clear in 1856 which he asked the committee to make clear in 1861. He would ask them to consider how the matter stood. On the part of the old company, there was a sufficient elevation for a constant service, and an inclination on the part of the company to do all that they could. On the part of the new company, there was sufficient water, but not sufficient elevation. Surely, when the amalgamation of the companies took place, and the special difficulties of each were removed by the combination of the two concerns, all reason for exemption ceased, and the rule of the old company ought to prevail with the new. What were the objections, which the promoters raised, to giving a constant service under pressure? The first was, that the ground would not bear the pipes, and that with the required pressure upon a system of mains, in a mineral district such as this, they could not be maintained without leakage. On this point, Mr. Bateman's evidence afforded a complete answer, for he showed that the district was not of a character to cause the mischief spoken of, and that the ground, in nine-tenths of the area to be supplied, was sound and hard. The next objection was, that the constant service would be a source of enormous waste, because people were likely to be careless about their taps. The evidence of Mr. Martin and Mr. Hawksley, applied to this point. It was material also on this subject, that Mr. Bateman dealt with the case where the people had not been accustomed to any high pressure whatever. The case of Glasgow was the one he spoke of, where the whole apparatus was one adapted to the intermittent system, and where cisterns were in use. But that was not the case at Wolverhampton; for, as the committee had heard, the new houses, and most of the poorer ones, had no provision at all for storing water: while the habits of the people were formed in accordance with the expectation of a constant service. Therefore, the danger of such waste as occurred at Glasgow could not be caused here. Moreover, it should be remembered that, when waste of this kind was continual, it became a nuisance to the householders; and, for their own comfort and convenience, it would soon be remedied. In reference to the evidence of the promoters, as to the experiment for ascertaining the waste during certain nights in which a constant service was maintained, he asked the committee to remember that, in cross-examination, Mr. Tomlinson admitted that his calculation at the rate of 211,000 gallons per night, included consumption and waste, and this, he (Mr. Hope Scott) submitted, was even then below the average consumption of most towns in the kingdom. As to the question of cost, he ventured to say that, in the case of a company who had accepted a monopoly of this kind, it was not one to which the committee would give effect, especially when they considered the almost admitted certainty that the furnishing of a constant supply would largely increase the receipts of the company. Their estimate of £500 a year additional expenditure as likely to be caused if this obligation were imposed them, was plainly an extravagant one. The truth was, the company found it more profitable to them to extend their supply elsewhere, instead of effectually meeting the wants of Wolverhampton. They had their grasp upon that town, and now they proposed to pay £500 a year to another company, to go into their district. Instead of laying out this £500 a year in fulfilling their obligations at Wolverhampton, they refused to do that which Parliament clearly intended they should do when the amalgamation with the old company was sanctioned, and had entered into arrangements to pay that money over to another company, for leave to supply within their limits. Was this fair and just to the inhabitants of Wolverhampton? Was it right that a population of 70,000 should be deprived of a constant service, in order that those who had the monopoly of supply might have the means of paying their way into another district? The committee had had abundant evidence of the present deficiency of water in the cases of fire which had been spoken to, and he thought they would be of opinion that, for the sake of the preservation of life and property in the town, better provision should be made for the future. Upon all these grounds, he asked their lordships, on behalf of the corporation of Wolverhampton, supported by a petition embracing a large number of the inhabitants, to do justice under the circumstances. He was content that the most stringent clauses should be inserted, to prevent and punish waste, but he would respectfully and earnestly submit that the company should be required to supply constant service under pressure, not only to meet the case of fires, but for domestic purposes.

Mr. ESPLIN, on behalf of the old company, put in the agreement of contract between his clients and the promoters, and other deeds. He said the agreement was that upon the old company's capital of £46,200, the new company should pay an annual rent beginning at 3 per cent., and increasing at certain periods until it attained to the rate of 5 per cent. The maximum would have been reached at Christmas next, but by a subsequent arrangement it had been postponed until the new company were able to pay a certain dividend to their own shareholders, and his clients were desirous that, if this bill became law, provision should be made by which their rights should not be endangered. The evidence of Mr. Bateman showed that the promoters were about to extend their works into very broken ground, which was in a constant state of settlement, and was altogether of a different character to that over which they were at present spread. It was very likely, therefore, that their annual expenses would be much greater, owing to the increased outlay for repairs from time to time; and, if that were so, the chance of his clients receiving their maximum dividend of 5 per cent. would be diminished, or at least postponed. In addition to that, the proposed increase in the new companies capital would still further increase the contingency, and make the future interests of their predecessors a matter of speculation. If the promoters were sincere in what they said, that the increased capital would enable them to enlarge their operations, and the sooner to meet their obligations towards his clients, let them show it by consenting to a clause, fixing the payment of the 5 per cent. dividend at the end of the next or the following year. He would also ask for a clause, providing that nothing in this Act should alter the position of the old company under their agreement, or else that the new company should not be entitled to 5 per cent. upon their new capital, and that, in the calculation of their working expenses, they should not include the money to be paid yearly to the South Staffordshire Company.

Mr. CLERK was about to reply to the observations of Mr. Esplin; but,

The CHAIRMAN said the learned counsel might confine his attention to the case of the corporation.

Mr. CLERK said the corporation appeared to think that circumstances now existed which required an alteration of the legislation of 1856. Whatever might be the intention of the promoters when this bill was deposited, as it now appeared before the committee it was purely a money bill, and related only to the raising of a further capital of £37,000, which Mr. Bateman had proved was absolutely necessary to enable the company to increase their works. The corporation alleged that it was a hardship upon them that the promoters were not put under an obligation to afford constant service. The old company, although bound to furnish such a supply, had never done so except for a limited period; and, when both the companies were before Parliament in 1855, and the corporation had also a scheme of their own, the Legislature did not think fit to impose such an obligation upon the new company, to whose plan they then gave their sanction. That the corporation were at that time fully alive to their own interests, was evident from the fact that they obtained the insertion of clauses limiting the companies dividends to 6 per cent., and requiring that the works should be transferred to them. They now came before Parliament, asking that the company should be placed under obligations to furnish a constant supply of water, the additional cost of which to them was proved to be £500 a year. The corporation did not propose to give up, or in any way to modify, their right of purchasing the undertaking; and, if their demand was acceeded to by the committee, the value of the undertaking would be diminished to the extent of £10,000 by the additional working expenses to which the company would be subjected. It was alleged that the present supply was inconvenient to the inhabitants, and that it was not sufficient to meet the exigency of fires; but it did not appear from the evidence that, had there been a constant supply, it could have been more readily obtained than it was in the cases which had been brought forward. Mr. Hope Scott had complained that, while the promoters objected to the additional cost which a constant supply to Wolverhampton would impose upon them, they had entered into arrangements for the supply of Bilston. But, if the corporation had any grounds for objecting to that course, they should have urged them when the company were before Parliament in 1855. By the Act passed in that year, the company were incorporated, with power to make and maintain works for the supply of water to the town and parish of Wolverhampton, and the suburbs thereof, and to certain other parishes in the counties of Stafford and Salop therein mentioned; subject, nevertheless, to a proviso, that the company should not supply the townships of Willenhall and Bilston with water, so long as the South Staffordshire Water-Works Company should supply the same. The latter company were not in a position, within a certain time, to do so; and, accordingly, this company undertook the supply. But, in order to prevent all disputes, and settle all questions which might arise, they agreed to pay the South Staffordshire Company, for a certain period, the sum of £500 a year, which period was about to expire. Having referred at some length to the evidence, the learned counsel said he thought, when the committee considered the nature of the district in which the company's mains were laid, they would not be disposed to call upon them to furnish a constant supply, seeing the enormous waste which it would involve; and, with regard to Wolverhampton proper, so long as the corporation retained the right to demand that the works should be handed over to them at any time, they would not impose the additional cost which such a supply would involve, and which, whenever the works came to be transferred, would be regarded as a depreciation in value, corresponding to such yearly expenditure. When the Legislature gave a company the right to supply a town, no doubt they conferred a great advantage upon that company, but they also conferred what they considered to be a corresponding advantage upon the inhabitants at large. Seeing, then, that all these matters were minutely inquired into in 1855, and the relative positions of the parties remained the same, he submitted that no case had been made out to justify an alteration of the legislation which then took place.

The room was then cleared. On the parties being called in again,

The CHAIRMAN said: The committee are of opinion that the town of Wolverhampton is not satisfactorily supplied with water, and they trust that the increased means afforded by this bill will enable the company to meet the requirements of the community. But they are not of opinion, that there is any change of circumstances which would authorize them to overthrow the legislation of 1855. The committee, therefore, are of opinion, that the bill should be proceeded with.

The clauses were then read over.

Mr. POWELL proposed the introduction of a clause, continuing the powers of the corporation to purchase the works of the company.

Mr. CLERK said there was not the slightest necessity for such a clause. The previous legislation on the subject remained the same, and nothing in this bill would affect it. If this clause were inserted, the inference would be, that there was something special before the committee, which necessitated the former provision being re-enacted.

Mr. POWELL said, the reason for making the application was, that the question had been mooted, whether this bill did not deprive the corporation of their right in this respect, and it was desirable to avoid litigation hereafter? The power of transfer in 1855 referred to the works of the new company; since then, the two companies had become amalgamated, and it might be a question whether that power would extend to the works of the old company.

The CHAIRMAN: Do you contend that there is anything in this bill that interferes with previous legislation?

Mr. POWELL: Not in this bill, but whether it may not with the operation of the Transfer Act.

The CHAIRMAN: It appears to me that we are acting essentially upon the legislation of 1855, and we cannot agree to insert a provision respecting something which nothing in this bill interferes with.

The Marquis of SLIGO: Would you not be satisfied with a provision that nothing in this Act shall be taken to interfere with or abridge the rights of the corporation under that Act?

Mr. POWELL: If the committee think they cannot go to the extent I ask, I shall be content with a saving clause of that character.

Mr. CLERK said it was quite unnecessary; but, as the promoters wished to act fairly to the corporation, they would not object to such a clause.

After some further discussion, Mr. POWELL consulted with his clients, and then said he was instructed to withdraw his application.

HOUSE OF COMMONS.

(*Before Mr.* C. R. M. Talbot, *Chairman; Mr.* Walter, *Sir* W. P. Gallwey, *Mr.* Wyvill, *and Mr.* Westhead.)

DUBLIN CORPORATION WATER BILL.

(*Continued from page* 304.)

Wednesday, May 1.

Sir W. Alexander, Q.C., resumed his address on the part of the opposition committee. He said that, from the result of Dr. Apjohn's analysis, it must have been an analysis not of water, but of mud; and he was confirmed in this view by an answer of Dr. Apjohn on cross-examination—namely, that it was not an analysis of water, but of a deposit found at the bottom of Portobello basin.

Mr. Barry: That was an analysis of the spongillæ.

Sir W. Alexander read a portion of the evidence to show that the analysis referred to a deposit found in the basin, and not to the water of the canal.

Mr. Wyvill: I think he was speaking of the water produced before the committee.

The Chairman: No; he referred to an analysis of the deposit in the basin—in fact, of mud.

Sir. W. Alexander proceeded to say that there was one point, in reference to the issuing of the royal commission, to which he wished to refer. It had been stated by Mr. Codd that the opponents joined in the recommendation for the appointment of a royal commissioner, and pledged themselves to be bound by his decision. That was not so. He found that a resolution in favour of the appointment of the royal commissioner was subsequently rescinded, for reasons which ought to have influenced the corporation—namely, an objection to bind themselves to adopt any scheme which the commissioner might recommend, constituting him a dictator from whose decision there was no appeal. Having read passages from Mr. Hawkshaw's report with respect to the Kippure scheme, the learned counsel said the quantity and quality of the water there were admitted, and it was acknowledged that there was no difficulty in the construction of works. The only thing objected to was the brown colour of the water. Having referred to some minor projects, the commissioner came to the Coyford plan, which the engineers of the corporation had recommended so highly that it was made the basis of a bill, as the committee had already heard. The recommendation of the Vartry scheme by the royal commissioner excited the utmost surprise in Dublin. It was only once or twice mentioned throughout the whole of the voluminous evidence in the Blue Book. It was only at the close of the inquiry that that scheme was brought before the commissioner. Mr. Hawksley, in his evidence, stated that it was the purest water to be found in any quantity near Dublin, and that he had no other information respecting it. He added that Mr. Hassard, the projector of the scheme, admitted to him that it was almost out of the question, on account of the expense it would involve. Mr. Hassard was not examined before the commissioner, nor was he brought before the committee, to give all the information in his power as to the district, and the reasons which had influenced him in recommending the Vartry. Mr. Hawksley condemned the scheme on the ground of cost, when the estimate was £250,000, with 10 per cent. for contingencies; and yet he now advocated the scheme, although he admitted that the cost of carrying it out would exceed £300,000. Mr. Hawksley had given excellent advice for the purpose of ascertaining the amount and quality of water supply—namely, the putting down of rain-gauges, analyses of the water in spring and winter, and experiments to ascertain the amount of evaporation. Not one of these precautionary measures recommended by their consulting engineer were taken by the corporation before the adoption of the Vartry scheme. These necessary steps having been neglected, Mr. Hassard not having been examined, and the Vartry having been only mentioned incidentally before Mr. Hawkshaw, it was with no little surprise the citizens of Dublin—and, no doubt, the corporation also—saw the Vartry recommended. In adopting the Vartry, Mr. Hawkshaw spoke of the facility it afforded for supplying Kingstown, Bray, and the other extra-municipal districts. With respect to that matter, Sir Edward Grogan, one of the members for Dublin, had stated that the introduction of the clauses empowering the corporation to supply those districts, was a breach of the understanding on which he had recommended the appointment of a royal commissioner. The supply of the extra-municipal district was, in fact, a speculation on the part of the corporation, to be carried out with the capital of the citizens of Dublin—a hazardous speculation, which was as likely to fail as to succeed. It had not been shown that the inhabitants of the extra-municipal districts would give up their present sources of supply from wells and pumps, in order to deal with the corporation. Two of the inhabitants of that district—Professors Jukes and Sullivan, who were examined as to other matters—had incidentally mentioned that they would be glad to do so. But the population of Kingstown, Bray, and Rathmines, was enormous, and the committee could not entertain the idea, for a moment, that the two gentlemen referred to spoke the feelings of the people. On the contrary, there were gentlemen from Rathmines present, who would tell the committee that the people of that district objected to take water from the corporation. Before the committee sanctioned that portion of the bill, they should be satisfied that the overwhelming majority of the inhabitants were in favour of accepting the supply; and not only that, but there should be compulsory clauses in the bill, to compel the taking of the water, before they allowed the corporation to enter on a wild speculation at the expense of the ratepayers—a speculation which was uncertain, and might be ruinous. The report was made on the 20th of October, 1860; the inquiry was held in August; and it was not until September, 1860, that a single gauge was put down in the water-shed of the Vartry. He was, therefore, justified in calling the Vartry scheme, ill-considered and hastily-adopted. It would be proved that the Kippure, or Ballysmuttan, scheme was wholly unobjectionable; that it was much less costly than the Vartry project; and that the only point on which the commissioner objected to it—namely, colour—could be obviated without filtration. The corporation engineers were of opinion that the Kippure water should be filtered; and they added to Mr. Bateman's estimate a sum of £15,000; but Mr. Bateman, the originator of the scheme, would show that that was quite unnecessary. The first objection to the Vartry scheme was, that sufficient water could not be collected to supply 12 million gallons per day to the city of Dublin. The calculation of the commissioner was made in the absence of rain-gauges or direct observations in the immediate district. In his evidence before the commissioner, Mr. Hawksley stated that, by taking the results of any proximate rain-gauge, the altitude of which above the sea was known, the rainfall of a particular district could be calculated, with a certainty of not being more than 10 per cent. in error, by adding 2½ inches for every hundred feet of elevation. At the time Mr. Hawksley made his calculation, he was not aware of the rain-gauge at Fassero, and based his calculation on the results given by the gauge in the Phœnix Park. He subsequently became aware of the gauge at Fassero, which he called a proximate gauge. He (Sir W. Alexander) submitted that Mr. Hawksley's formula was fallacious, and not reconcileable with known facts. The result of Mr. Hawksley's first calculation was, that the supply from the Vartry would be only 12¼ inches; whereas, 17½ inches would be required. The supply would thus fall short by 5 inches. That was a calculation on the assumption that two reservoirs would be required. The compensation-reservoir was subsequently given up; but, on the other hand, a great portion of the district which would supply that reservoir was thereby lost. In fact, the drainage area would be reduced from twenty-six to twenty-two square miles. The subsequent calculations from the Fassero guage showed that there would be a deficiency of 1 inch, which, according to Mr. Hawksley himself, would deprive 50,000 people of their daily supply; whilst the loss of 8 inches would totally annihilate the supply of 400,000 people. The question of rainfall was, therefore, one that demanded the most careful consideration, and any conclusion arrived at respecting it should be founded on actual observation, not on speculation or theories. He would demonstrate that Mr. Hawksley's formula was fallacious and discordant in its results. It was unknown to meteorologists who had made the subject their study. Mr. Glaisher said that it was new to him. Mr. Hawksley's rule, applied to the Phœnix Park gauge, gave an available rainfall of 12½ inches at the Vartry; applied to the Fassaro gauge, it gave a rainfall of 19 inches. The same rule, therefore, applied to different places, gave a difference of 34 per cent. The learned counsel here referred to the case of the Whittledean Water-Works, to show the danger of relying on calculations of this nature. Mr. Simpson calculated, that at Whittledean, the fall would be greater than at West Denton; and yet it turned out that, when there was a fall of 42, inches at the latter place, 34 inches only could be obtained at the former. Mr. Glaisher's rule was arbitrary. There were no certain data about it, except the rainfall in Dublin, and the result was not only at variance with known facts, but was irreconcileable with Mr. Hawksley's formula. He would now call attention to the actual observations which were made in the Vartry water-shed. Three rain-guages were put down in September last, and the result of the observations had been furnished since the inquiry commenced. He would compare these observations with the result given by the gauge at Fassaro at a much lower elevation. One of the guages set for 107 days, gave a return of 19 inches; while, for the same 107 days, the Fassero guage gave a return of 24 inches. Working out the rainfall according to Mr. Hawksley's formula, the fall at the higher elevation ought to have been not 19 inches, but considerably greater than 24 inches. The main result of the three main guages for the ninety-three days, during which they were simultaneously exposed, was 22 inches; whilst, at the lower elevation, the main rainfall was exactly the same. The period during which these gauges were set was exceedingly wet, and more rain fell than had fallen in the like period in former years from the time the Fassaro gauge was set. Mr. Bateman, who was perfectly conversant with water supply, and had constructed works for the supply of nearly 2 million people, and had devised, and was engineer for the supply of 1 million persons more, would be examined, and would show that, in his judgment, and according to his experience, the Vartry would not supply 12 million gallons a day. The evaporation and absorption would amount to 18 inches a day, making the required rainfall 32½ inches. The gathering ground on one side was a slightly undulating plain, partly consisting of arable land, and at the other the hill rose to an altitude of 2300 feet, thus obstructing the passage of the rain-clouds to the east side of the mountains. Mr. Bateman's estimate for an ample supply of pure water from Kippure was £230,000, and he would undertake to give 12 million gallons daily, taking the water by separate reservoirs, so that, without filtration, the water would be supplied perfectly colourless. So certain was he of the accuracy of his calculations, that he would undertake to construct the works for the sum he had estimated. Was it not hard that the citizens of Dublin should be saddled with £70,000 more in hard cash, for it must be borne in mind that £300,000 would only bring the water to Leeson Street; and then came the expense of the distributing process, which Mr. Hawksley estimated, at the lowest, at £15,000? Surely, under the circumstances, the petitioners were right in asking the committee to pause, and see whether the proposed scheme was not exceedingly questionable, and whether a cheaper plan was not practicable? They asked the committee to reject the bill, and allow the other scheme to be considered, which could be done before the next session of Parliament. What interest could such men as the Archbishop of Dublin, the Chief Justice, the Lord Justice of Appeal, and the eminent merchants who had signed the petition, have in this question, except to procure the best and cheapest supply? They had shown their sincerity by subscribing largely in support of their petition. They did not put forward a rival scheme; but, when they found that the present project was founded on erroneous calculations, and would involve great expense to secure a supply as to which there was no certainty, they thought it right to urge before the committee that the scheme was ill-considered, and that it ought not to be hastily imposed on the citizens of Dublin. Was there anything so urgent in the matter that the bill should be now hurried forward? He had been surprised to hear some of the medical evidence given on behalf of the promoters; but, as he listened to what must be regarded as exaggerations, he felt somewhat relieved, for he had heard Dr. Corrigan stating that the badness of the water led to intemperance, whilst another medical gentleman gave it as his opinion that the bad supply of water led to prostitution! When such exaggerations were indulged in, the impressions which the evidence might otherwise have made must be greatly weakened. He (the learned counsel) had always heard that Dublin was one of the most salubrious cities in the world; and, notwithstanding the number of its poorer inhabitants, the epidemics which often prevailed elsewhere had been rarely heard of there, although the water supply had been derived from the canals for the last sixty years. It was a mistake to suppose that the petitioners objected to an improved supply. On the contrary, their object was to have that plan carried out which would give them the best supply at the cheapest rate. They did not represent a monopoly, or seek to back any rival company—in fact, no such company existed. The corporation might still be promoters of the bill, but the petitioners earnestly asked the committee to pause for a little, and not to allow the corporation to carry out a scheme which was hasty and ill-considered. The learned gentleman concluded by stating that he would only call a few witnesses, but that their quality would make amends for their deficiency in point of quantity.

John F. Bateman, Esq., F.R.S., examined by Mr. Hannen.

I am a civil engineer, and a Fellow of the Royal Society. I am engineer to about twenty water-works, and I devised and constructed works to supply 2 million of people at an expense of £2,000,000. I constructed the works for the supply of Glasgow from Loch Katrine. In 1836, I gave to the subject of rainfall much consideration. I have examined the water-shed of the Vartry district, which has an entire gathering ground of 13,628 acres, inclusive of the 600 acres which will be required for the reservoir,

the rainfall into which will hardly compensate for the evaporation. The extent of country available to rainfall will be about 13,300 acres. A rainfall of 14 inches and 4-10ths will be required to supply 12 million gallons per day. I have reason to believe that 16 or 18 inches must be allowed in that district for loss by evaporation, &c. With the exception of one-third of the whole district, about 5000 acres on the east side of Douce mountain, I never saw a district in which the loss was likely to be so great from evaporation and absorption as the Vartry catchment. It is, for the most part, an undulating plain, and cannot be called a valley. It is more like a mountain shelf than any thing else. [The witness here pointed out the various localities on the map.] Eighteen inches is as little as could safely be allowed for absorption and evaporation, which would require a rainfall of 32 inches to yield the required supply. Two-thirds of the flat ground are under cultivation, and broken up, being thus favourably circumstanced to increase the absorption. About one-third of the entire gathering ground is situate at the east slope of the Douce mountain, which, being, 2300 feet high, shuts out the most favourable and frequent rain-winds. The configuration of the Vartry ground gave a key to the fall of rain. It is true that on the easterly sides of hills the fall of rain is greater up to a height of 1600 feet than on the westerly sides; but, this is not the case when the altitude is above 2000 feet. I have founded this opinion on my observations of the rainfall in the Penine Hills in Lancashire. [The witness illustrated his statement, by pointing out on a map the gathering grounds of the Liverpool and Bolton Water-Works.] I am engineer to the Bolton, the Darwen, the Chorley, and the Blackburn Water-Works, and the guages placed in those districts were under my care. The inference to be drawn from the returns of these guages is, that there is more rain to the west than to the east, and that the largest fall is deposited in the first trough after the last range of hills, not exceeding 1200 feet high; and this further inference is to be drawn, that the further east you go, the less rain there is to be deposited.

Mr. WALTER asked the witness, was he of opinion that the rainfall increased with elevation to a certain height?

Witness: Yes; my experience goes to show that it does; but the fall depends so much on local circumstances, that no accurate calculation can be arrived at on the subject, as a general rule. [Witness here described the situation of the catchment basins of the Sheffield and Glasgow Water-Works, and stated the result of the rain-guages on the hills there, showing a rapid diminution of rainfall from south-west to north-east.] Dr. Miller and I first became correspondents on the subject of rainfall in the year 1844, and I have obtained returns of observations made by him in the Cumberland lake district from 1844 to 1854, which confirm the results I had myself arrived at. [Witness here handed in a table, showing the results of Dr. Miller's rain-gauges.] Since February last, rain-gauges have been set at Blessington, and at Ballysmuttan, and the result has been a rainfall of 36 inches at Blessington, and of 56 inches at Ballysmuttan. The Fassero rain-gauge receives a very large amount of rain as compared with the other rain-gauges near Dublin. It shows a larger fall than the gauges at the Phœnix Park, at Milltown, at the Royal Dublin Society, and other places. From its situation, it is exposed to the westerly and south-eastern winds, and thus obtains a larger fall than other districts not far removed from it. This shows the impolicy of taking such a gauge as that of Fassero as a guide for the fall that may be expected in other districts situated quite differently. With certain winds, the rain would have to pass over twelve miles of country, more than 2000 feet in height, before it could be deposited in the Vartry district. This would be the case with a due west wind. In this case, it would not only have to pass over the tract of country to which I have alluded, but also over Lough Dan and Lough Tay, by which the quantity would be still more decreased. On the day on which I visited the Vartry district, the Douce mountain was capped with clouds, which were being constantly dispersed by the winds. We were quite certain that it was raining heavily on the other side of the mountain, but a single drop of rain did not fall in the Vartry catchment on that day. On the following day, we visited the locality at the other side of Douce mountain, and found, as we anticipated, that there had been a heavy fall of rain there, thus showing that the rain-clouds had been interrupted by the mountain, and prevented from falling into the Vartry district, in accordance with the theory which I have stated. The question of evaporation is a most important matter to be taken into consideration in the construction of water-works. The loss by evaporation and absorption was shown at Bolton to be 17·95, or, in round numbers, 18 inches. In Leeds, the average fall for ten years was 29 inches per year, and the loss was 17 inches. The Newcastle case showed the rainfall to be very much short of the requirements of the people; and cholera raged where the water ran short, showing strongly that proximate rain-gauges are not to be relied upon. The rainfall of Whittledean, where the catchment turned out to be very far short of that at West Denton, and where the observations were made from the rain-gauges, was this—for eight years the rainfall at Newcastle was 35 inches, while for eleven years the fall at Whittledean was only 23 inches. The fall ought to have been the same at both places if the calculation had been correct.

By Mr. WESTHEAD: The entire amount collected in 1851 was only 8 inches at Whittledean, with a rainfall of 21·33.

The CHAIRMAN: Could that be accounted for by leakage?

Witness: No, sir?

Examination continued: For 240 days, the reservoirs at Whittledean went constantly down. From May to September, they only collected 3 inches out of a rainfall of 14¼ inches, showing a loss of 11¼ inches in the six months. I will mention one other instance. It is a case of my own, in the Warrington district. In 1854, we only collected 8 out of 27 inches—thus losing 19 inches; and for 240 days, the reservoirs went constantly down.

The CHAIRMAN: Was there any leakage?

Witness: No. I never saw a basin so unlikely to collect rain as the Vartry basin. I speak of the flat and gradually-sloping ground—not of the mountain side of which I have already spoken. The only catchment basins I know like it, are those at Leeds and Whittledean, the latter of which approaches nearest to it, but is a better basin. The evaporation at the Vartry would be from 16 to 18 inches. I would not reckon on a greater available rainfall than 12 inches, which would be altogether insufficient. Fourteen inches and a half would be required, at the very lowest, to supply 12 million gallons per day.

By the CHAIRMAN: The evaporation and absorption at Kippure would be about 15 inches. The position of the two catchments is altogether different.

Examination resumed: I am engineer to the Kingstown Water-works Company. The supply I calculated on from the Kingstown catchment was 12 inches. It is more favourably circumstanced than the Vartry catchment.

THURSDAY, MAY 2.

Mr. *Bateman*, recalled and examined by Mr. HANNEN.

The fall of rain varied in Glasgow from 60 to 35 inches. This was for a period of six years. I do not agree with Mr. Hawksley's formula. From February, 1860, to February, 1861, the rainfall at Mountjoy barracks was 32 inches; at Blessington, 35; at Ballysmuttan, 56; and on the Sea Fin Mountain for eleven months, 46½ inches. In Mr. Hawksley's evidence before the royal commissioner, he stated, as a rule for calculating the increase of rainfall according to elevation, that if, to the results obtained by any proximate gauge (when you made the necessary reduction for the level of the sea), you add 2½ per cent. for every 100 feet of elevation, you will arrive at the amount of rainfall at a place of greater elevation than that particular locality. Mr. Hawksley referred to certain returns which I had given from the Sea Fin Mountain, in corroboration of his formula. I thought the rule so contrary to my experience that, having a good many rain-returns with me, I worked out the calculations according to the formula, as compared with the actual facts, and handed them to the commissioner the next day. A number of these returns taken by Mr. Miller were from places in the Cumberland lake district, within about 200 feet of each other; and, therefore, they ought not to have varied more than 5 per cent. from each other. For instance, at Whitehaven, where the proximate gauge was situated, the rainfall in 1855 and 1856 was 49 inches; and, according to Mr. Hawksley's rule, not one of the returns to which I allude ought to have given 52 inches. Yet, this was the state of facts. At Whitehaven, in 1855, the fall was 49 inches; while at Keswick it was 62; at Emmerdale, 77; at Lowswater, 69; at Buttermere, 87; and at other places in the same locality 108, 121, and 136 inches. The results were nearly the same in 1856. [The witness here gave the results of the rain returns at Rivington Pike (Liverpool) and other districts as compared with the results given by the application of Mr. Hawksley's formula to the proximate rain-gauges, in order to show that the rule could not be depended upon.]

Mr. WESTHEAD: Have you any rule of your own?

Witness: No; I am aware of the fact that more rain falls on high land than on low land—in a mountainous district than in a plain; but the increase varies so much, according to local circumstances, that it is not safe to depend on any fixed or general rule.

Mr. HANNEN: Then, you think that neither Mr. Hawksley's nor Mr. Glaisher's formula can be depended on?

Witness: My opinion is, there is no rule by which the rainfall can be calculated. You must rely on experience, actual observation, and the comparison of analogous districts. I think it would be most unsafe to rely on any dogmatic rule, such as that given by Mr. Hawksley. From the facts which I have been able to observe, I think that the rain deposited on the eastern meridian may be attributed to the Vartry district, and the rain on the western meridian to the Ballysmuttan district; and the proportions, as to the superficial extent of rain which would fall on those districts, would be as 6·6 to 3·5 in favour of the Ballysmuttan district.

Mr. HANNEN: Would you think it safe to institute any scheme for the supply of a city like Dublin from an anticipated fall of water on a given area, without actual observation?

Witness: I should not, unless I had a very large gathering ground to collect from, which would put the matter beyond doubt. If, instead of being obliged to measure in every acre and every drop of water to get the full amount required, I had three or four times the extent of country to collect from, I might then dispense with actual observation by rain-gauges. I have found, by comparing the returns of the gauges at Ballysmuttan and Fassero, from February to December last, that my view, as to the fall of rain during easterly and westerly winds, is confirmed. Fassero is situated similarly to the Vartry district.

The CHAIRMAN: Have you made a comparison between the rainfall at Ballysmuttan and the Vartry district during the prevalence of a southerly wind?

Witness: I can hardly tell. I think there would not be much difference; but, probably, a due south-west wind would deposit more rain in the Vartry district.

Sir W. GALLWEY: If you lived on the bank of a river, and were in the habit of seeing it flow daily, would that enable you to form an idea of the quantity of water that could be derived from it?

Witness: Not in the least.

Sir W. GALLWEY: Suppose you saw a considerable flow in it during dry weather, would not that enable you to form an idea?

Witness: That depends on the geological formation of the country.

Sir W. GALLWEY: I mean from the actual flow in the river during dry weather, leaving geological considerations out of the question. If, every year in dry weather, you saw a large flow in the river, would not that enable you to form a judgment?

Witness: No.

The CHAIRMAN: Do you say that water comes from no other source than the rain?

Witness: I do; it comes from springs of course, but those are supplied by the rain percolating through the soil.

By Mr. WESTHEAD: The ordinary flow in a river amounts to 1400 of an ordinary flood.

Examination resumed: I have examined the estimates of the corporation, and made my calculations thereon. My estimate amounts to £227,000 against £216,000, the estimate of the corporation for the works, that is to say, mine is about 5 per cent. higher. But their estimate makes no provision for contingencies, for which 10 per cent. certainly should be added. These amount to upwards of £22,000, making in all £250,000 for the engineering works. That does not include the purchase of lands, or compensation to millowners and others. The works are, no doubt, easy of construction, the site for the reservoir safe and eligible, and the works could be carried to Dublin without any considerable engineering difficulty. With reference to the purchase of land, I place little reliance on the accuracy of the estimates. In Manchester, the estimates were from £60,000 to £70,000. I calculated the sum to be required for land at £90,000, and it cost £92,500. In Glasgow, the estimate was £50,000, and the actual cost was £90,000. I am of opinion that you may almost double any estimate before you can get at the sum that will be required. In this case, I have estimated the cost of the purchase of land at £29,000, about £5000 higher than the estimate of the corporation. That would make the estimate for land and engineering works £279,000. I have no doubt that the total cost will exceed £300,000, the estimate of the corporation. I consider that the limitation of the service-reservoir at Stillorgan to three days supply is not judicious. It should at least be large enough to contain ten days' supply; for, if any accident happened to any part of the long line of works between it and the storeage-reservoir, the city of Dublin would be left without water. To increase the size of the reservoir, in order that it may contain ten days supply, would take £18,000 more, which would have to be added to the estimate.

I have not included compensation to the Kingstown Water-Works, nor the cost of the necessary works from Leeson Street through the city. Nor have I included any sum for the purchase of the rights of the millowners on the river, nor for compensation to the Wicklow Harbour. These items, which I have not calculated, should be added to the estimate. The water of the Vartry is white and good, but I believe it will be vapid to the taste, as all water from clay-slate is. I believe from the shallowness of the stream favouring the growth of vegetables, the water of the Vartry will require filtration as much as the water proposed in any of the other schemes. Should there be a failure in the supply, water could be got from the Dargle or Lough Dan, but that would involve the construction of an entire set of works, at great additional expense. I believe that an ample supply of pure water can be had for the city of Dublin for £100,000 less than the cost of the scheme proposed by the corporation, according to my estimate. I think, by proper treatment, the canal water may be rendered fit for human use; but, it is a hard water, and not such as a city like Dublin should be permanently supplied with. It is a wholesome water, clear and palatable, and the citizens can get on very well with it until a better scheme is carried out. I believe the Ballysmuttan scheme is the best and cheapest that can be devised for the supply of Dublin. The only objection raised to it by Mr. Hawkshaw was the brown colour of the water. Mr. Hawkshaw is a very eminent engineer, but he is not conversant with water-works. I am not surprised that he should have objected to the Ballysmuttan water, as it was very brown when he saw it. But, having been for many years engaged in dealing with brown water, I have no doubt that that objection can be perfectly removed. We have had the most extraordinary evidence in reference to the water supplied at Manchester, which was quite as brown as that at Ballysmuttan. It was represented that it would poison the inhabitants, that it was as brown as porter, that it stained linen washed in it, and that cattle refused to drink it. Notwithstanding all these representations the bill passed. A plan was adopted by which the pure was separated from the coloured water, and Manchester is now supplied with water of as great purity as any city in the world, not excepting Glasgow. The springs in cold weather are perfectly colourless. In dry weather, in summer, they are also colourless; but, when much rain falls, they become flooded, and are brown in colour, and unfit for use as a town supply. Taking advantage of this circumstance, the brown water was separated from the pure water by a very simple process, which I will endeavour to explain, and the result is, as I have said, that Manchester is supplied with a perfectly colourless water. [The witness here explained, by means of a model, his mode of separating the coloured from the pure water, and exhibited a sample of the water now supplied in Manchester, which had been a year in bottle. He poured out some of the water, which was tasted by the committee.] Since I learned that the only objection of the royal commissioner to the Ballysmuttan water was its colour, I asked a gentleman to collect samples of it; and I now produce about thirty samples taken at Ballysmuttan Bridge, from October to April. [Witness here produced the various samples referred to.] Some of this water, continued Mr. Bateman, is quite as good as that at the Vartry. It is as good as that supplied to Manchester; and the brownish-coloured water, after remaining for some time in the reservoir, would become perfectly colourless, and fit for use. My plan of supplying Dublin, according to the Ballysmuttan scheme, is similar to that detailed before the royal commissioner. According to my calculation of the rainfall, Ballysmuttan would yield 27 million gallons, which would afford a supply of 12 million gallons to the city, and 6 million gallons as compensation to the river, leaving a surplus of 9,329,000 gallons, which might go either for error in calculation, or for extra-dry years, or for the rejection of the most highly-coloured water. In fact, supposing my calculation to be correct, 9 million gallons of water might be rejected daily, if it were found to be coloured, and sufficient water collected from pure sources for the supply of the city; but, taking an average year, during which the reservoir would be filled with water, a much larger quantity of pure water would be available. My estimate for carrying out the Ballysmuttan scheme is £213,000, which includes the purchase of land and way-leave. So satisfied am I of the accuracy of my calculations, that I would undertake to carry out those works, and to supply Dublin with water equal to that of the Vartry, for £230,000—being £70,000 less than the promoters estimate for the present scheme, and £100,000 less than my estimate of the cost of the project.

The CHAIRMAN: Do you include in your estimate compensation to millowners?

Witness: There is to be no money compensation whatever. The millowners will be compensated by water.

The CHAIRMAN: Is the Grand Canal Company a supporter of the scheme you recommend?

Witness: Not that I know of.

Sir W. GALLWEY: I suppose you are aware that contractors have tendered for the construction of the works at the sum estimated?

Witness: Yes; but the contractors tenders were for the works laid before them. No engineer, I am sorry to say, gets the work carried out without certain contingencies, which have not been taken into account in Mr. Hawksley's estimate of £216,000, nor allowed for in my estimate of £227,000.

By the CHAIRMAN: No contingency ever falls on the contractors, but there is always an allowance made for contingencies, which must be paid for.

By Mr. WESTHEAD: Of course, they would fall on the corporation.

Cross-examined by Mr. CALVERT, Q.C.: I was employed some years ago by the Royal Canal Company to report on their canal. I am not now engaged professionally on their behalf. I appear here on behalf of the citizens who are opposing the bill. I was first communicated with on this subject by Mr. Brophey and Mr. Venables, early in the February of the present year. Mr. Brophey is a solicitor acting on behalf of the ratepayers. No particular persons were mentioned to me as the ratepayers, on whose behalf I was to appear. I went over to Dublin in March, and met some of the ratepayers. I do not remember their names. I appeared before Mr. Hawkshaw, the royal commissioner, in Dublin.

Mr. CALVERT: At the close of the inquiry, did you not thank the commissioner for the attention with which he had listened to you, and express your admiration of the clear manner in which he had apprehended every fact laid before him, and your confidence that whatever opinion he arrived at, would be free from any misconception on his part?

Witness: I did.

Mr. CALVERT: Do you adhere to that opinion now?

Witness: I do.

Mr. CALVERT: Did you not express your astonishment, that in these days of enlightenment, the citizens of Dublin should be content with a supply from such an impure source as the canals, when a good, pure, and wholesome water was within their reach?

Witness: Yes; and I still hold that opinion. The supply to Manchester is at the rate of 20 gallons per head per day. I believe Mr. Hawksley, by his estimate, proposes to give 25 gallons per day to each of a population exceeding the present number of the inhabitants of Dublin. I think the only supply that can be calculated upon from the Dodder is about a million and a half gallons a day. That water is sufficiently good for the use of the city. I think, on the average, the whole drainage to the Ballysmuttan reservoir would amount to between 50 and 60 inches per annum. I prepared some of the questions which were put by Sir William Alexander to Mr. Hawksley, on cross-examination.

Mr. CALVERT: Did you intentionally omit any question on the subject of the Fassaro rain-guage, in order that you might have an opportunity of expressing your opinion, whilst Mr. Hawksley would not have the opportu- of expressing his?

Witness: The omission was quite unintentional on my part. My opinion is, that no rain would get into the Vartry district from the west or the north-west, owing to the elevation of the hills. In fact, I believe that in the whole range of the Wicklow Mountains, or in the entire of England, Ireland, or Scotland, you could not find a place which will produce such little rainfall as the Vartry catchment. I heard of Mr. Glaisher's evidence. I do not think that his conclusion is correct. I have said that the water of the Vartry has a vapid taste, owing to the want of æration. I am aware that Mr. Hawksley and Mr. Glaisher were not examined in reference to some of the places to which I have referred in the course of my evidence.

Mr. CALVERT: Then, do you think that you should have referred to them?

Witness: Yes; those gentlemen stated such cases as they thought would bear out their calculations, and I have stated those which I consider bear out mine.

FRIDAY, MAY 4.

Mr. *Bateman*, recalled, and cross-examined by Mr. CALVERT.

I produce a table of calculations of rainfall, with respect to the Ballysmuttan scheme, as mentioned in my evidence of yesterday; also, a detail of the estimates I made for the carrying out of that scheme. There were three rain-gauges in the Ballysmuttan district, one at Blessington, one at Ballysmuttan, and one at Seafir. The gentleman who sent them, and made the observations, will hand in the results. I have no memorandum as to my first interview with Mr. Venables, but, on the 20th of February, I received a letter from Mr. Brossley, at Manchester. It was directed to Mr. Venables, and he forwarded it to me, with a request to go over to Ireland, in order to examine the Vartry district. The plain portion of the Vartry district is two-thirds of the whole, as contra-distinguished from the mountain districts. I took my calculations from the Ordnance map. I spent two days at the Vartry, and went from one end of the basin to the other. As nearly as possible, I examined the whole district, as well as if I had been a week upon it. [Witness here pointed out on the map various points in the Vartry basin which he had particularly examined.]

Mr. CALVERT: Did you ask at the police station about what quantity of water fell in that district?

Witness: Indeed, I did not. I should as soon have thought of asking the police for the latest news from China. I did not see Mr. Tottenham's mill. I did not go down the river below the reservoir. It was not, of course, necessary to do so.

Mr. CALVERT: Did you not know that the millowners were opposing the bill?

Witness: I did not, and do not know it up to the present time. The distance from the most easterly point of the Ballysmuttan, collecting to the most westerly point of the Vartry collecting ground, is about three miles. From the same point at Ballysmuttan to Fassero, is eight miles. I calculated the extent of the gathering ground at the Vartry, and at Ballysmuttan, from the Ordnance map. A large surface of the Ballysmuttan soil consists of peat soil. I do not know the extent. It is not a black peat. Peat is pretty much of the same colour in all places, if it be genuine peat. No portion of the gathering ground—or, if any, a very small portion—is under plough cultivation, only a couple of fields. There are not more than 200 acres under cultivation in the valley, the greater part being coarse pasture. There could be 312 million cubic feet of pure water gathered per day at the Ballysmuttan reservoir. The water is colourless during five months in the year, and more or less coloured during the remaining seven months. During the latter, the springs which are colourless, could be used for the supply of the city. The colour of the water depends upon the temperature. The action of the sun on the peat and vegetation causes the water to be coloured; but, at the same time that that takes place, the springs are beautifully clear; and, besides, there will be months during the summer when pure water can be taken from the river, and stored in the lower or white water reservoir for the use of the city. [Witness here produced a bottle of perfectly clear water, taken from the river, at Ballysmuttan, on the 29th of April last; also a bottle of equally colourless water taken on the 26th of April, 1860.] If March and April were dry months, the white water reservoir would be not quite full on the 1st of May. It would be quite sufficient to secure an ample supply of water for the city. There would be five months during the twelve when the water would be fit for storeage. The reservoir would hold sufficient for seven months consumption. I take the winter water as being, as a rule, perfectly clear water; but, as I have shown by samples, there are other months during which clear water could be stored. [Mr. Calvert here handed witness a bottle of water, slightly tinged.] I will not undertake to say that the water was not gathered in the month of January. It might be taken from the top of a flood; but, I do not say that that is not a fair specimen of the water to be got in January. I produce four bottles of water, taken during four different days in the month of January, which are fair specimens; and the water is clear.

Mr. CALVERT: Would you say that this [a bottle of brown water produced] was not taken from Ballysmuttan in the month of August?

Witness: Oh no. I can show you water of a deeper brown. [Bottle produced.] I admit that that water is dirtier than that I produced, but I should have no occasion whatever for it, as I have shown you. I believe the Coyford scheme was opposed by the millers. As a rule, millowners oppose every scheme. No good scheme was ever carried without some amount of opposition.

Mr. CALVERT: Is it not of importance that the river should be kept as full of water as possible?

Witness: Under some circumstances—

Mr. CALVERT: Answer, "yes" or "no?"

Witness: I cannot answer yes or no.

Mr. CALVERT: Do you not know whether it is of importance?

Witness: I do, but I cannot answer your question "yes" or "no."

Mr. CALVERT: What answer, then, do you give?

Witness: That under some circumstances it is, under other circumstances it is not.

Mr. CALVERT: Is it desirable that the harbour should be kept as full as possible?

Witness: Of shipping?

Mr. CALVERT: No, of water; did you understand me to ask as to shipping?

Witness: I cannot say that I did; but, from its position, your question can have no bearing upon the harbour.

Mr. CALVERT: But if you answer about shipping, and I ask about water, we shall never bring the inquiry to a conclusion.

The CHAIRMAN: To what part of the river does the question refer?

Mr. CALVERT: To Ringsend, the part of the harbour that is to be kept supplied by the canal company. Are you aware that the contractors have taken the contracts subject to contingencies?

Witness: I am not. In the first place, there are no contracts. They are merely tenders.

Mr. CALVERT: Well, the tenders. Are you aware that they are taken, subject to all contingencies?

Witness: I am not.

Mr. CALVERT: Did you hear the evidence?

Witness: I did, and I saw the witnesses turning round evidently not knowing what to say about contingencies.

Mr. CALVERT: When they said they would complete the works, do you not give credit to what they stated?

Witness: I am satisfied that what they did state was true, but it all depends on the tenders. Not having seen the tenders, I cannot say what they are confined to, but of this I am perfectly sure that there will be contingencies which must be paid for.

Re-examined by Mr. HANNEN: Before I went to Ireland to report on the Vartry for the committee, I distinctly told them I would not be the advocate of any particular scheme, but would give them my honest opinion as to the particular project, and I have done so. Before I went, I procured the Ordnance and parliamentary maps, and made my calculations, so that I had the figures prepared as to extent, and was quite prepared for the examination of the district. Before seeing the committee on my return from the Vartry, I had the estimates worked out, and I told the committee that the scheme was an expensive one, that it would cost from £70,000 to £100,000 more than one, two, or three schemes equally good in point of water, and that I was of opinion that a sufficient supply could not be obtained from the Vartry basin.

Mr. HANNEN: You expressed to the committee the opinion you have deposed to here in this committee?

Witness: I did; exactly the same.

Mr. HANNEN: Did the opposition committee suggest to you to put forward the Ballysmuttan scheme?

Witness: They did not. They left the matter in my hands, exactly as I have stated.

Mr. HANNEN: Would the Ballysmuttan scheme be opposed as the Coyford scheme was by the millowners?

Witness: There would be opposition, I dare say, as there is to every scheme; but, there would not be equal ground for opposition.

Mr. HANNEN: I believe you wrote a letter, on the subject of the water supply, to the Lord Mayor?

Witness: I did.

Mr. HANNEN: Was there, then, any reason for your suggesting Ballysmuttan, as you did, if you thought any other scheme better?

Witness: No reason whatever. I knew of no schemes except the Coyford and canal, each of which was the subject of a bill in Parliament. That led me to examine the subject more particularly; and, I satisfied myself that the Ballysmuttan scheme would be not only better, but cheaper, than any other scheme.

Mr. HANNEN: Your recommendation, then, was made solely on public grounds?

Witness: Solely. I had no hope whatever of either reward or even thanks. The Vartry scheme was merely mentioned incidentally before the commissioner. There was, in fact, no opportunity for ventilating it. It was an untried and undiscussed scheme, not prominently put forward. I was not invited before the commissioner to state my opinion as to it. The canal scheme, as proposed, would cost £137,000 for works, the capitalizing of the rent would be £90,000, for filtration, £150,000—total, £242,000; being £58,000 less than the estimate for the Vartry, namely £300,000, for which sum I am satisfied the present project cannot be carried out. The canals, at present, yield water that the citizens may be satisfied with until they are quite sure that they have the very best scheme for an improved supply before them. With respect to Ballysmuttan, I have taken everything as much against that district as possible. I have given it very much worse than it would be found in practice. There will be a surplus of 9 million gallons per day. With respect to the colour of the water, I may mention the case of the reservoir at Bolton, the Belmont water-works, where the water was as brown as the Liffey water. On one occasion, I saw it so brown that you could not see an inch down into it. Yet, in three weeks after being exposed to light and air, it was so clear that you could see down several feet into it. I have put my plan into practice successfully at Manchester, and at several other places, without any filtration. In deep reservoirs there is no vegetation. I have no doubt whatever, that as good a supply of water could be procured from Ballysmuttan for Dublin as that given to Manchester or Glasgow, and these two are, I believe, without any exception, the best supplies in the world. There has been no opportunity of taking a sample of coloured water from the Vartry. Autumn would be the most likely time to procure it. I produce a bottle of water which I took on the 12th of March from the Vartry. It is not colourless, but it is beautiful water, and with proper exposure to the light it could be delivered perfectly colourless.

The CHAIRMAN: Was it collected in stormy weather?

Witness: It was; but there was very little rain in the Vartry basin.

Mr. HANNEN: Have you ever resorted to the police to make your observations in so important a case?

Witness: Oh! never in any case.

The CHAIRMAN: Do the canal companies oppose the Ballysmuttan scheme?

Witness: I do not know, at all.

Mr. WALTER: Are the committee to understand that the ratepayers, whom you represent, approve of the Ballysmuttan scheme, and are prepared to adopt it?

Witness: I durst not answer that question. I have not ascertained their opinion.

Mr. WALTER: Do you appear on your own behalf, or are you authorized to express the opinion of the ratepayers?

Witness: I am authorized to show that the Ballysmuttan scheme is a better scheme, in all respects, than the Vartry—cheaper as regards price, more certain as regards the quantity, and as good as regards the quality of the water. I should mention, that I do not take it upon myself now to state that the Ballysmuttan is the very best scheme that could be devised for the supply of the city of Dublin, because I do not think that there has been a proper and sufficient investigation as to the choice of the schemes. Every one who thought proper to propound a scheme was at liberty to come in and do so; and there has been no responsible investigation—no investigation on the responsibility of the engineer himself.

Mr. WALTER: I wish, also, to know whether, in the event of the Ballysmuttan scheme being adopted at any future time, it would be available for the supply of the Bray and Kingstown districts?

Witness: Just as easily as in the other case. There is only a little difference in the elevation of the proposed reservoirs. Bray is not so conveniently situated for supply as Kingstown.

Mr. WALTER: Then the supply of Bray would involve an increased estimate?

Witness: A very small increase, indeed. The distribution-pipes would be the same in both cases. It would involve four miles of pipe, at a cost of from £7000 to £10,000.

Mr. WESTHEAD: Do I understand you to say that the Ballysmuttan scheme is infinitely preferable to any supply of water from the canals?

Witness: The Ballysmuttan water is certainly much better than the canal water.

Mr. HANNEN: A question has been asked, whether the ratepayers, who are here represented, approve of, and would adopt, the Ballysmuttan scheme. In the absence of my learned leader, I should not like to take on myself to answer that question. Perhaps, the chairman would ask it when Sir W. Alexander is present.

The CHAIRMAN: I will do so.

Mr. WYVILLE (to Mr. Bateman): What do you calculate that the supply from the Vartry basin would be?

Witness: On full consideration, I do not think it would be safe for an engineer to calculate on more than 12 inches of available rainfall from the Vartry.

The CHAIRMAN: What would be the expense of bringing the water of Lough Dan to the reservoir?

Witness: About £40,000 or £50,000; and, besides, Lough Dan should be raised, so as to insure the getting of the summer water. If you brought more water, you should also increase the capacity for storeage.

The CHAIRMAN: What is the difference between the area of the Vartry and the Ballysmuttan district?

Witness: About 4000 acres, in favour of Ballysmuttan.

The CHAIRMAN: What is the difference in the rainfall of each district, as compared with Dublin?

Witness: There is more rain at Vartry than at the Phœnix Park, in the proportion of 22 to 28; and more rain at Ballysmuttan than at the Phœnix Park, in the proportion of 22 to 39.

The CHAIRMAN: You say that the distance between them is only three miles?

Witness: That is the distance between the nearest points of the respective collecting grounds; but there is a distance of twelve miles from the centre of one basin to the centre of the other; and, between the two reservoirs, there would be, not a great gulf fixed, but a great wall.

Mr. WESTHEAD: What did the Manchester works cost?

Witness: £1,300,000, including the purchase of the old works.

Mr. WESTHEAD: What is the result?

Witness: It is a most beneficial scheme, indeed. A large revenue is derived from the supply of water to manufacturers, and the rates levied only amount to 6d. and 2d.

Mr. WESTHEAD: Can you state the population supplied?

Witness: About 600,000 people.

Mr. WESTHEAD: What do you estimate the cost of the proposed works at?

Witness: From £330,000 to £350,000; and to that you should add the expense of the rearrangement of pipes and distribution of the water, so as to make it available throughout the city. That I estimate at from £40,000 to £50,000. About £400,000 would cover the cost.

Mr. WESTHEAD: If the Dublin people expended so large a sum, relatively, as the Manchester people, in proportion to the population, would not the outlay be £866,000, taking the expenditure at Manchester at £1,300,000, and the population 600,000, and the population of Dublin 400,000, and the expenditure £400,000?

Witness: The £400,000 does not represent the cost, as compared with £1,300,000. The latter represents all the previous cost, and the purchase of existing companies. The new works, including everything, cost £700,000; and the £400,000 for Dublin does not include the existing debt of £72,000.

Mr. WESTHEAD: Well, then, Dublin would be subject to £472,000, for the supply of 400,000 persons, whereas the actual cost at Manchester, for all purposes, was £1,300,000, for a population of 600,000?

Witness: Just so, sir; £700,000 for the works. And here the expenditure of £400,000 is on the supposition that a sufficient supply would be obtained.

By the CHAIRMAN: I calculate the evaporation at the Vartry basin at 16 inches. At Ballysmuttan, I might take 12 inches, but I allow 15 inches.

By Mr. WALTER: The Glasgow works cost £1,800,000, for the supply of 500,000; and the Liverpool works £1,500,000, for the supply of a like amount of population.

Sir W. ALEXANDER: In reference to the question asked by the honourable Member, Mr. Westhead, let me ask, what is about the valuation of Manchester?

Witness: About £1,500,000.

The CHAIRMAN: What proportion does that bear to the actual rent?

Witness: It is about five-sixths.

Sir W. ALEXANDER: In one case, you have a valuation of £1,500,000, and a low rate; in Dublin, a valuation of £400,000, and a very high rate.

Mr. *W. G. Merrey*, examined by Sir W. ALEXANDER.

I reside at Blessington. The specimens of water produced were fairly taken, on successive Mondays.

Cross-examined by Mr. BARRY: They were taken between twelve and one o'clock on each Monday, near Ballysmuttan Bridge. I am under-agent to Lord Downshire, who opposed the Coyford scheme.

The Rev. *J. Galbraith*, F.T.C.D., examined by Sir W. ALEXANDER.

I am professor of experimental philosophy in Trinity College, Dublin, and the author of several mathematical works. There is an observatory attached to the University. It was erected in 1837, on the suggestion of Dr. Lloyd, now a senior Fellow. I have paid great attention to the question of the quantity of rainfall. I have known the Vartry district for several years, and have ascended the mountains frequently, for the purpose of making barometrical observations. In going from Dorice to the Sugar Loaf, I have frequently crossed the northern portions of the Vartry basin. When I heard of the Vartry scheme, I was very much surprised at it, from the general character of the district, and its position with respect to the Wicklow mountains. I believed that it was very badly circumstanced for a

water-shed. I obtained a copy of the commissioner's report, and applied myself to a consideration of the question of supply. Having ascertained the quantity that would be required, and the number of persons to be supplied, it was easy to ascertain that 14 inches would be necessary. The question required nice consideration, owing to the limited area. It was a matter of extreme importance whether a sufficient quantity would be obtained for a great city, and to guard against contingencies. I came to the conclusion that it could not. The area, according to Mr. Hawksley's calculations, is little over twenty-one square miles, which would be 13,400 acres. To supply 12 million gallons from that area would require an available rainfall, over and above all loss by evaporation and absorption, of 14·2 inches. I calculate the evaporation and absorption as 18 inches, which would require a fall of 32·2, and to depend on such a fall, in so limited a basin, would, I believe, in dry years be attended with danger to the city of Dublin. The average fall in dry years, as shown at the observatory in Trinity College, is 22 inches, and at Fassero from about 26½ to 29 inches. Even if the basin at Vartry was equal to the Fassero district, the supply would be too limited; and I saw no reason to suppose that there would be as great a fall at Vartry as at Fassero. The greatly elevated district above the Vartry, and extending to New Ross, occupies an area of 1800 to 2000 square miles. Some of the mountains are 3000 feet in height. [Witness here produced a map of the the mountain district, and pointed out the Vartry and Fassero basins; he also handed in the following return of rain-gauges at Fassero and the Vartry basin:—"Fassero rain-gauge compared with those of Anna Carter Bridge, Knockatemple, and Liture, for the whole periods during which they have been observed. (Assuming the elevations of the gauges to be 800 feet above the sea according to Mr. Neville's evidence, the rainfalls according to Mr. Hawksley's formula should be the number of inches given):—205 days, (10th of September, 1860, to 3d of April, 1861):—Fassero, 41·44 inches (according to actual return); Anna Carter Bridge, 44·82 inches; by Mr. Hawksley's formula they would be 47·24. 176 days (9th of October, 1860, to 3d of April, 1861):—Fassero, 39·05 inches; Knockatemple, 33·81 inches; by Mr. Hawksley's formula, 44·52. 107 days (17th December 1860, to 3rd of April, 1861):—Fassero, 24·06 inches; Liture, 19·77 inches; by Mr. Hawksley's formula, 27·43 Fassero gauge, compared with the mean result of those of Anna Carter Bridge and Knockatemple from the time the latter was fixed, 176 days (9th of October, 1860, to 3rd of April, 1861):—Fassero, 39·05 inches, from actual observation; mean of the two gauges, 37·62 inches; by Mr. Hawksley's formula, they would be 44·52. Fassero gauge, compared with the main result of those of Anna Carter Bridge, Knockatemple, and Liture, 93 days (1st of January, 1861, to the 3rd of April, 1861):—Fassero, 23·33 inches, from actual observation; mean of the three gauges, 22·31; by Mr. Hawksley's formula would be 25·45 inches. The rainfall during the first three months of the present year is excessive, being much greater than that of the same month in any year since the Fassero gauge was set down. The greatest and least rainfalls are as follows—1861, January, February, March, 20·33 inches; 1855, January, February, March, 3·44. The rainfall of 1855, although undiminished by evaporation or absorption, would not yield 12 million gallons per day for the period of three months."] From the position of the Vartry, being placed at the extreme eastern boundary of the great granite chain of mountains, it appears to me, according to the statement of meteorologists, and my own experience, ill calculated to receive rain-bearing winds. It is, in fact, as it were, protected from those winds, not only in the west and south-west, but in the south also, but particularly so in the south-western direction. The east and south-eastern directions only are open to the rain-clouds. A great portion of the catchment is flat, and there is no head to the valley—a fact which makes it a bad gathering ground, because the south and south-easterly winds, which blow up the Vartry, would not, owing to its configuration, be arrested, but would be carried across it, and would deposit their rain beyond. The result of Dr. Miller's observations is that, as a general rule, the rainfall increases according to the elevation; and that, at an elevation of 2000 feet, you receive the maximum density of the rain-clouds. There are, however, numerous remarkable exceptions to that general rule, and I should expect to find many such exceptions in England.

Sir W. ALEXANDER: Every one supposes they live in the wettest place on the face of the earth. Now, can you tell me the wettest place in England?

Witness: Seathwaite is the wettest district in England.

Sir W. ALEXANDER: Then I will avoid it. What is its elevation?

Witness: 368 feet. The average rainfall there for seven years was 142 inches. In the year 1848, 162 inches fell. At the Sprinkling Farm, a proximate district, the average fall for seven years was, at an elevation of 1900 feet, 148 inches. That may be taken as a proof of what I have already stated. I have examined Mr. Hawksley's formula. It is unnecessarily complicated.

Sir W. ALEXANDER: And somewhat mysterious.

The CHAIRMAN: Do you concur in the accuracy of his formula?

Witness: No, sir. I dispute its principle and its accuracy. When before the commissioner, Mr. Hawksley took the rain-gauge at the Phœnix Park as a proximate gauge; which, by his calculation, gave 27¼ inches of rainfall at the Vartry. Afterwards, he took the Fassero gauge as a proximate gauge, which gave, by the same formula, a different result. If we had another proximate gauge, no doubt the result of all three, applying the formula as the basis of calculation, would be inconsistent with each other. In the two cases he took, there was a difference of seven inches in the calculations of the rainfall at the Vartry. When before the commissioner, Mr. Hawksley did not know of the Fassero rain-gauge, and accordingly took the Mountjoy gauge. When a formula is found to give inconsistent results as to the same district, it ought to be abandoned. If the rule be good for anything, it should work back as well as forward. He takes the Vartry fall at 35 inches. Working back, according to the formula, to ascertain the minimum fall at the lower elevation at the Mountjoy barrack, it would make the rainfall 28·6 inches, the actual minimum being 22·8. Therefore, working backwards or forwards, the formula, which allows 2½ inches for every 100 feet of elevation, is found to be altogether erroneous. There is a like difference when calculating the mean rainfall according to the formula. It is not therefore to be relied on, and should be rejected, particularly when it is sought to make it the basis of calculation for the supply of water to a city containing a great population. I never heard of the formula until I saw it in the book. There are cases which I could furnish from the west of Ireland, which falsify the principle relied on in support of the bill—the case of Cong, Oughterard, and Maam, in Connemara. Cong is distant from Maam 11½ miles, and from Oughterard, 8¼ miles. They are the three points of a triangle. In 1851, there fell 84 inches of rain at Maam, and at Cong, 45 inches. In 1856, there fell at Oughterard, 50 inches, and at Cong, 8¼ miles distant, 33 inches only. I can mention an instance in the north of Ireland, which shows the amazing disparity between prominent gauges. I allude to the results shown by gauges at Ballyconnell, Belturbet, Butler's Bridge, and Cavan, at a few miles distance from each other. In the year 1854, the rainfall at Belturbet was 40 inches, and at Cavan, 10 or 11 miles east of it, the rainfall was as low as 31 inches. In 1851, the fall at Belturbet was 30 inches, and at Butler's Bridge, only 4¾ miles distant, 21 inches.

Sir W. GALLWEY: To what do you attribute these facts?

Witness: To aspect and local circumstances.

Sir W. GALLWEY: I ask the question because these instances would tend to show that no observations can be relied on, in order to arrive at a general rule.

Witness: Even supposing that I was unable to give any reason, the facts themselves must be accepted as facts; and it appears to me, that they give a very sufficient reason for not depending on proximate gauges. But, generally speaking, we cannot account for them. The science of meteorology is a very uncertain one.

Sir W. GALLWEY: You object to the Vartry because it has no valley?

Witness: No sufficient valley, and has no head to it. [Witness here pointed out on the map the mountains bounding the Fassero district, and described the configuration of the ground.]

Examination continued: My reason for believing that the rainfall will be greater at Fassero than on the Vartry water-shed is, that the former is a centre, towards which a number of valleys converge. In 1860, 33¼ inches of rain fell at Markstown, as shown by Mr. Pim's rain-gauge; at Trinity College, 36 inches, in the same year; and, at Fassero, 57 inches; the difference of elevation being 100 feet, showing the inaccuracy of Mr. Hawksley's formula. In 1856, a dry year, the fall of rain at Fassero was 38 inches. The regularity of the supply is an important consideration with a view to storeage, as several days supply might be lost, and it is often very irregular at Fassero. For instance, from August, 1853, to January, 1854, the fall was 23 inches, and the fall for the next six months, 9 inches. In one month, the fall was 7 inches, a very high per centage on the fall for the year, the total of which was 38 inches. I was present when Mr. Glaisher stated the rule on which he made his calculation. I do not concur in its accuracy. He took the mean fall at Dublin to be 28 inches, which, I think, is inaccurate. He then multiplied that by 1·6, in order to get the mean rainfall at an elevation of 1000 feet, which gave, in round numbers, 45 inches. He then proceeded to obtain from the mean what the minimum would be, by subtracting from that mean one-third of the extreme between the wettest and driest years. In Dublin, he said, that would be 19 or 20 inches, which is true; but he said that, at an elevation of 1000 feet, it would be double that—40 inches. He gave no reasons for that, nor is there any reason that could be given that I am acquainted with. He then deducted one-third for the mean rain-fall, and assumed 32 inches as the fall in the Vartry, in the driest season. Now, the real elevation is 1300 feet; and, if 1·6 be a proper meter for 1300 feet, you should take for 1000 feet a factor of 1·48. If you cut down the factor from 1·6 to 1·5, which would be still too high, the result would be 42 inches; and, subtracting the same amount as he took, we have 29 inches of rainfall, instead of 32 inches.

Sir W. ALEXANDER: Have you ever met with the rule Mr. Glaisher gave in any book; or have you ever heard of it before?

Witness: No. It was as new to me as Mr. Hawksley's formula. I can furnish sixteen actual cases contradictory of the rule. The water falling into a reservoir is only equal to the evaporation from the reservoir; so that the area of the reservoir should be deducted.

The CHAIRMAN: Do you prefer any one of the schemes to the others?

Witness: No; I do not prefer one more than another.

MONDAY, MAY 6.

Professor *Galbraith* recalled, and examined by Sir W. ALEXANDER.

I can furnish the monthly and daily returns of the Fassero rain-gauge for 1860 and 1861. The meteorological observatory at Trinity College was erected at the suggestion of Dr. Lloyd, who is eminent as a meteorologist. In the year 1851, he presented a report to the Royal Academy, of his observations at sixteen different stations, with regard to the rainfall. After giving the results at each of the stations, he says—"Thus it will be seen, that the greatest rainfall at Cahirciveen is nearly treble the least rainfall at Portarlington. The mean rainfall throughout Ireland was 34½ inches. The places of least rainfall are either inland, or on the eastern coast." The least amount of rainfall was 21 inches; and the greatest, at Cahirciveen, was 60 inches. With respect to evaporation, I made an experiment at Trinity College, the result of which was, to show that the amount of evaporation from a water surface is exactly the same as the rainfall. In the instance to which I refer, the rainfall was 36 inches, and the return from the water surface was the same, showing that the amount of water that would fall on the reservoir would only equal the evaporation from the surface. There would, of course, be less evaporation from a shed than from flat ground; because, in the former case, the water would run off, and could be collected. A mountain track would resemble a shed. A flat country would bear a resemblance to the Vartry district. Two-thirds of the area, or 60 per cent., may be counted as flat, inasmuch as no part rises above the other more than 200 feet. The least allowance that should be made for evaporation from the Vartry district is 18 inches. An experiment by Mr. Dalton, at Manchester, showed an evaporation of 25 inches; but I do not think the evaporation at the Vartry would be so much. At Greenock, the evaporation was 20 inches out of a rainfall of 60 inches, or one-third of the rainfall. In the growth of plants, there is a great absorption of water, and cultivated ground would absorb a great amount of the rainfall. It is calculated that a crop of wheat would absorb 5 inches of rain per acre. The Vartry basin is considerably broken up by the plough, and intended for cultivation. The amount of evaporation depends, to some extent, on the wind. It would be greater in the Vartry than in a valley which had a head. The Vartry having no head, the wind sweeps through it. I live in Rathmines district, and my house is supplied with water from two pumps, and a reservoir which catches the rain-fall, and contains about 700 gallons. I never heard my neighbours in the Rathmines express any desire to be supplied with water from the Vartry. On the contrary, they are opposed to it. A meeting was held in Rathmines on the subject; and, though two or three gentlemen spoke in favour of the bill, on a poll being taken there was a large majority against it, and half a dozen in favour of it. The half dozen included members of the corporation. Professor Jukes, who was one of the witnesses examined for the bill, spoke at that meeting in its favour. I have no personal feeling whatever on this subject. I enter on the opposition because I believe the Vartry district will not give the required supply. I wrote two or three letters to the Dublin morning prpers, but they were on that subject alone. Mr. Bateman, when he came to the opposition committee, begged to be understood that he was not coming to uphold any particular scheme as absolutely the best; that, though he proposed a scheme, he was of opinion that the district of Dublin had not been fully investigated, and that a better scheme might be devised than any that had been proposed.

Sir W. ALEXANDER: You were asked by the chairman, on Friday, whether you preferred one scheme to another—do you not wish to explain your answer?

Witness: I do. I understand the question to be, whether I had any particular interest in any of the schemes, and I answered in the negative; but, if I was simply asked whether I preferred one scheme to another, I would answer in the affirmative. I consider the Vartry scheme decidedly the worst, except the Dodder, where the area is more limited. I consider others better—the Coyford, for instance, the supply from which would be beyond doubt. I consider the canal high-level scheme better for some reasons, and also the Ballysmuttan. I would say that the Ballysmuttan scheme was the best, and the Vartry scheme the worst.

The CHAIRMAN: Do I understand you to say that in Rathmines you do not want a compulsory supply?

Witness: No, sir. I consider an improved supply for the city desirable, but the only reason I interfere in the matter is, that I believe the supply would be deficient, and that much unnecessary expense would be thrown upon the citizens of Dublin. In fact, if I had been satisfied in my mind, by fair reasoning, that the Vartry would give a sufficient supply, even though objections might have been raised to it, I would not have taken any part in the opposition. I appear here merely as a citizen of Dublin, interested in the welfare of the city in which I was born, and anxious for a permanent and sufficient supply of water to its inhabitants—the best supply that can possibly be obtained. Further than that, I have no interest in the matter.

Cross-examined by Mr. BARRY: To a considerable extent, the committee who oppose the Vartry scheme are the same who opposed the Coyford scheme. That scheme was vigorously opposed.

Mr. BARRY: Do you remember that the King of Siam did not believe in the existence of ice?

Witness: I have heard of it.

Mr. BARRY: Do the people of the Vartry believe in the existence of rain?

Witness: I should say, they have occasional showers.

Mr. BARRY: Just enough, I suppose, to remove their scepticism on the subject.

Cross-examination continued: I am a member of the opposition committee, and have attended its meetings. On the 14th of March, Mr. Bateman made his report as to the Vartry, to which he had gone on the 12th. I do not know whether he gave a written report. I never saw it. I had previously formed an opinion as to the Vartry myself. Dr. Lloyd, who resides near the Vartry, is decidedly of opinion that this is a bad scheme. I believe the canals have subscribed to the opposition fund about £100 each. I do not know how many subscribers to the fund are holders of canal stock. Mr. Joseph Hone is a subscriber to the fund. I do not know that he holds canal stock to the amount of £11,000. I do not know how much he holds. I am a very bad authority in these matters. I know it is the opinion of the committee that the Vartry is the worst scheme of all. The majority of the gentlemen constituting the opposition have no feeling in the matter. Their only anxiety is to get the best possible supply. Master Fitz Gibbon, in his pamphlet, recommends the canals as the best and safest source of supply. I have a great respect for Master Fitz Gibbon, but I am far from agreeing with him in all his statements. In many points in that pamphlet, I do not agree with him; and I can say that this recommendation of the canal scheme is not the sentiment of the opposition committee generally. Some members of the committee are in favour of the canals, and the general opinion is, that the water of the canals is not so bad that we cannot live on it for some time until the best scheme for supplying the city is devised and carried out. I never went on the committee as a canal man. I think it a fair thing to ask Parliament to give the citizens of Dublin time to consider and investigate the question of the water supply. I do not know whether there is a fire-plug in Rathmines; nor do I know anything of the negotiations between the Rathmines commissioners and the corporation, or between the canal companies and the corporation. I do not know that 10 million gallons was the utmost supply per day ever offered by the canal companies. I dare say that would be sufficient for the city alone. Ten million gallons per day would give a population of 400,000 people 25 gallons per day each.

Mr. BARRY: How many inches of rainfall would you say could be relied on in the Vartry district?

Witness: Mr. Glaisher says 19, and Mr. Bateman 12. Well, there can be no positive opinion by any man, and no opinion would be valuable without actual experiment. I will, however, take the rainfall to equal that at Fassero, though there are good reasons for supposing it would not. During the driest year at Fassero, the rainfall was 26 inches; and during the next, 27 inches. The year before it was 34 inches. The mean would be 29 inches, from which deduct 18 inches, and you will have an available rainfall of 11 inches.

Mr. BARRY: How many gallons per day would that fall yield from the Vartry district?

Witness: Nine million and three quarter gallons.

Mr. BARRY: How many million gallons per day will the storeage reservoir of 200 days supply yield?

Witness: You should remember that, instead of 11 inches of rainfall, the lowest that could be depended upon for the supply of the city is 14 inches. With respect to the reservoir, you cannot get more out of it than you put into it. If you have but 11 inches to put into it, that is all you can get out of it. I have taken in my calculation the years that Mr. Hawksley took himself. It is not fair to take a full reservoir to start with. It has the effect of increasing the three years by 200 days added in from a previous year. The 200 days supply would give for a year 2 million gallons per day; which, added to the 9¼ gallons, would give 11¼ million gallons; but I insist that taking the 200 days supply would lead to a very great mistake. From 1859 back, there were six dry years.

The CHAIRMAN: You say that, after three years, the difficulty would arise?

Mr. WALTER: And that you have no right to spend your capital?

Sir W. GALLWEY: If you start with a full reservoir on the 1st of January, 1863, what would be the condition of the reservoir on the 1st of January, 1866, after three dry years?

Witness: After the three years, the supply would be exhausted.

Mr. WESTHEAD: At the end of the first year, you would have exhausted one-third of the supply from the reservoir.

Mr. WALTER: And the water would be deteriorated as it got lower.

Mr. WESTHEAD: In the first year, 666 million gallons would go; and the same in the second and third years.

Mr. BARRY: I am showing that, even in the extreme case of three dry consecutive years, we could carry on.

Witness: The case is against you; for, at the end of the three years, all the storeage would be gone.

Mr. BARRY: But, as I said, that is an extreme case; you are supposing a fourth dry year, which is an unprecedented case.

Witness: I beg your pardon. We have had six consecutive dry years, not only in Ireland, but in England. [Witness here produced returns, showing the minimum rainfall for 1854 to 1859 inclusive.] The average was 22·8 inches at the Mountjoy barracks. The average for the same six years at Fassero, was at 32·7. The six years were not dry at Fassero, whilst they were dry in Dublin. I will take 1853, 1854, and 1855, the three dry years Mr. Hawksley took, though one of them was wet, and the mean was 29 inches. We have not had six consecutive dry years at Fassero, in our limited experience of it; but it would be absurd to say we might not. Eleven inches of rainfall, if you get it, from the Vartry, together with 1½ million gallons from the Dodder, would give 25 gallons per head per day to a population of 400,000; but that is 2 millions less than your bill proposes to give.

Mr. BARRY: No matter for that. So much for the ruin of Dublin from want of water.

Cross-examination resumed: Meteorology is rather undefined as a science. I have seen the Liverpool catchment basin. I have never seen a catchment reservoir in actual operation. I heard Mr. Glaisher swear that he was for ten years assisting Dr. Miller in his observations on rainfall in the Cumberland lake districts. I have no doubt that what he stated was true. I do not recognize him as a meteorologist of repute, but he had certain experience in the use of instruments at Greenwich observatory, and when employed by the Royal Society. Dr. Miller lays down as a general rule that there is an increase of rainfall according to the elevation. I know that Dr. Miller in his original work on this subject speaks of Leathwaite, where there was an unusually large fall in comparison with its elevation, as an exceptional case. He attributed the great fall of rain there, to the fact, that the head of the Wastdale Valley would stop the passage of the rain to Leathwaite, but in a subsequent report communicated to the Royal Society he admitted that there was really no head to the Wastdale Valley, that it was a press from one valley to another, and favoured the fall of rain at Leathwaite.

Mr. BARRY then asked the witness some questions with reference to the position of the Flosh, and exhibited a tracing of the cost near Whitehaven.

Witness observed that he had never been at Whitehaven, and could not say whether the positions had been correctly indicated.

Mr. BARRY: Then, in fact, you know nothing about it?

Witness: I know this about it, that a great deal of rain falls there, and I know the position described in Dr. Miller's book. But I do not recognize the points in the tracing, not having been there.

The CHAIRMAN said he had been there, and that the points were not correctly given. Therefore, he did not think it should be used.

Cross-examination resumed: In a letter which I wrote to the *Saunders's News Letter* on the 4th of March, I spoke of Mr. Hawksley, the consulting engineer of the corporation, as a very cautious man, and an engineer of great experience.

Mr. BARRY: Did you refer in that letter to your knowledge of the configuration of the Vartry basin, and its position with respect to the Wicklow mountains, as the reason that induced you to think that there would not be a sufficient supply?

Witness: I did not; but the whole tenour of my letter was to show that a sufficient supply could not be depended on from that district, in consequence of its limited area. I did not consider it necessary to say any thing in my letter about my personal knowledge of the district. In order to make a letter in a newspaper effective, it should not be too long. If you consider it any great fault to have left out that fact, I plead guilty. My acquaintance with the Vartry district was not subsequently acquired, but was acquired some two or three years before, whilst conducting a long series of barometrical observations.

Re-examined by Sir W. ALEXANDER: I was well acquainted with the Vartry before I wrote the letter alluded to, and I have been there since, with Mr. Bateman. After three dry years, the Vartry there would be no storeage water in the reservoir. The mean depth of the reservoir would be 20 feet. The greatest depth would be 60 feet, and the bottom slopes upwards. There is nothing to be found in Dr. Miller's book about Mr. Hawksley's formula, or like Mr. Glaisher's rule. I do not think the quantity of water in a stream on a particular day is a fair test of the quantity that might be expected from it. The flow may be unequal on different days.

By Mr. WALTER: I know the Vartry, at the Roundwood district, where it is proposed to construct the embankment. The reservoir will be very shallow at some points.

By the CHAIRMAN: I do not adopt Mr. Hawksley's doctrine at all. I object to Fassero as a proximate gauge. The local circumstances are altogether different.

Dr. *Neligan*, examined by Mr. WEBB.

I am Vice-President of the College of Physicians in Ireland, and the author of a number of treatises connected with my profession. I was for thirteen years physician to Jervis Street Hospital, and was lecturer to the Dublin School of Medicine for eighteen years. I have been a physician for the last twenty-five years. Epidemic diseases and affections, such as are usually supposed to come out of bad water, are scarce in Dublin as compared with large towns in England. In Jervis Street Hospital I had very large opportunities of seeing the inhabitants of the poorer districts on the north side of the city. I am confirmed in the opinion which I have expressed with reference to the absence of choleraic disease by Drs. Minchin and Mayne, the general officers to the workhouses. Medical men generally, I believe, share that opinion. I use the water supplied by the corporation daily. It is on my table for lunch every day. I do not know that my filter is particularly good. Dr. Macnamara was at my house since his return from London, and tasted some unfiltered water from my cistern, and said he would never wish to drink better. I was not a member of the opposition committee last year. Having read Master Fitz Gibbon's pamphlet, I was induced to look into the matter, and was told by a resident in the Vartry district, that in the summer the people who lived there and their cattle were often perishing for water. I am satisfied with the present water supply to Dublin; but I believe it would be desirable to get water not quite so hard. I myself would prefer a hard water, because I believe it would have an effect in preventing choleraic diseases. I mean to say, that the present water is fit for human use, and I should like to see an improved supply for the city of Dublin; but I am greatly opposed to mere theories, and should like to act on certain information. I do not believe that the attainment of a better supply would be imperilled by the rejection of the present bill. I am more than ever confirmed in my opposition to the present scheme, by the evidence which Professor Galbraith has given.

Cross-examined by Mr. BARRY: I believe the present water supplied to Dublin to be remarkably good. I do not believe there is any liquid manure in the bottle of water I produce, and which was taken from my cistern a week ago. I do not think it well to look too closely into everything we eat and drink; if we did, we might starve ourselves. I should not like to see a dead cat in my cistern; and I do not think it likely we shall see such an animal in it. I did not attend the poor at their houses when I was connected with the Jervis Street dispensary. My present practice is rather among the higher classes. I do not care for water at a high pressure. I suffered a good deal by the servant leaving the cook turned.

The case for the opposition committee here closed.

Mr. BARRY then applied that Mr. Hawksley should be permitted to make some observations on the evidence which had been given by Mr. Bateman and Professor Galbraith, as he had not been cross-examined as to several matters to which their examination had been particularly directed.

The counsel for the opposition committee and the canal companies objected to Mr. Hawksley's re-examination, and the committee decided that it was not necessary to recall him.

Mr. HOPE SCOTT then addressed the committee on the part of the canal companies. He said, the agreements under which the city was at present supplied, were entered into in 1806; so that there was no pressure, as regarded time, for providing a new supply. The agreement with the Grand Canal would terminate in 1865; but the chairman of that company had written a letter to the corporation, stating that the company would continue to supply the water, at the same rate of remuneration, until 1868, so that both agreements might terminate at the same time. The rate of payment varied, for it was 15 per cent. on the gross rents received by the corporation. If, therefore, there was a sufficient supply of good water, the question was not one as to whether there was any immediate pressure. It appeared, by a return of the town-clerk, that, for a population of 350,000, there was a present supply of 25 gallons per head per day. Therefore, it was the fault of the corporation if water were not introduced into the houses of the poor, which was said to be so necessary. At present, the pressure varied from 42 feet down to 11 feet above the pavement; and the corporation had the power for the last fifty years of taking water from an elevation 30 feet higher. They had, however, neglected to do so. What then was the quality of the water? The canal-water had been soundly abused before the committee; but, in 1845, Dr. Apjohn analyzed it, and pronounced it "soft, sweet, and wholesome, and well adapted for domestic use of every description." He said that it was neither unpleasant to the taste, nor injurious to health. From 1847, to 1860 inclusive, there had been no fewer than seventeen schemes for the supply of Dublin with water, and nine of them were canal schemes. Could the committee believe, in the face of that fact, that the canal-water was noxious and unhealthy—the ditch, in short, which it had been described? One of these nine projects had been recommended by the Dublin Sanitary Association; and some of them had originated with the corporation, and had been made the subject of a bill in Parliament. It had been proved that day, by Dr. Neligan, that the water was pure and wholesome. What was the complaint now made against it? That it contained spongillæ. Why, spongillæ had been found in the New River, which supplied part of London, and in the Chelsea water; and they had been removed by Mr. Simpson, the engineer of the Chelsea works, by a process of filtration. Their existence in the pipes of Dublin had been occasioned, he contended, by the negligence of the corporation, in not using proper precautions to remove them, and keep the pipes clean. Mr. Hawksley had himself recommended the canals as a source of supply. He was of opinion that a guaranteed supply was all important, and gave this reason—that a mistake as to 1 inch of rainfall would deprive 5000 inhabitants of their daily supply, and that a mistake of 8 inches would deprive 40,000 people of their daily supply. No stronger reason could be given in favour of accuracy, and that alone should make the committee pause before they adopted the Vartry scheme, as to which such positive evidence of deficient supply had been given. Before the royal commission, the Vartry scheme was unrepresented. It was only spoken of incidentally. It appeared to be destitute and friendless; and what kind of sentimental feeling induced Mr. Hawkshaw to adopt it, he could not say. Probably, he thought he would devise something superior to what anybody else had imagined. The Vartry project was never seriously taken up until August last, and then it was hastily adopted. The learned counsel here commented on the evidence of Mr. Bateman and Professor Galbraith, respecting the rainfall at Vartry, and submitted that it would be rash to spend £300,000 on a scheme as to which no certain data existed. Mr. Bateman guaranteed to supply 12 million gallons a day, for nearly £300,000 less than would be spent on the present project, if carried out; but with that he (Mr. Scott) had nothing to do. He was not an advocate for the Ballysmuttan scheme. He was for the canal scheme, and he submitted that it ought not to be set aside, and found to be a bad one, except after a fair and full investigation. The canal company would give, from a high level, 10 million gallons a day. If they did not give it, they would not get the £4000 a year. In the case of the Vartry project, however, if the supply failed, there would be no remedy, for the money would have been spent. The corporation themselves admitted that the canal-water could be greatly improved as to quality; whilst, as regards quantity, it was a matter of absolute certainty. Whatever might be the final result, Dublin was not perishing for want of water; and he submitted, to say the least of it, that the question was not sufficiently mature for decision.

TUESDAY, MAY 7.

Dr. *Minchil*, examined by Mr. JOHNSON.

I am a physician residing at Dublin. I am physician to the North Dublin Union. I am also lecturer on the *materia medica*. I reside on the north side of the city. My water is supplied from the canals. It is a good, wholesome water—rather hard. I never filter it. I cannot trace any disease to the drinking of that water. I have devoted much of my attention to the causes of disease. Disease does not prevail much in Dublin in the autumn. Whatever disease exists does not owe its origin to the canal-water, I am clearly of opinion. I have attended the North Dublin Union for twelve years, and never heard any complaints about it. I produce specimens of the water. The bottle of it I now produce was taken from the harbour on Tuesday last. The North Union have a pump, from which they take spring water in large quantities. Some prefer the one water, and some the other. Pipes are laid through the union, and the inmates have the option of taking either description of water. I heard of the evidence given by Dr. Corrigan. His account of the causes of the diseases arising from the water is not correct. Most of the inmates of the union, on their arrival, are fit subjects for an hospital. I do not agree with other opinions on this subject as given by Dr. Corrigan. If there is any impurity in the canal-water, it arises from its being drawn from a low level. If it were drawn from a higher level, its impurities would cease. All its impurities could be removed by filtration. It is by no means stagnant. The upper stratum particularly is not open to that designation. The Vartry is much more liable than the canal-water to be contaminated. I do not think the present supply of water to Dublin gives rise in any way to intemperance. Wherever pumps exist, they are highly prized by the people. Wherever we have bored, we have got pure, excellent water. The water at the lying-in-hospital is very satisfactory—at least, I have heard so from the medical men of that institution. I can say the same with reference to the water supply to the city hospital. Dr. Corrigan obtained his samples by removing the sand, and thus occasioning the water to be extremely muddy. There are three vertical cylinders; the water percolates upwards; then it has to travel through about four feet of sand; and then it passes through the other cylinders. I understand Dr. Corrigan's specimen was taken from the bottom of the first cylinder. The water from there would not be satisfactory. It would be an exaggerated specimen.

Cross-examined by Mr. CALVERT: I know there are many filters in Dublin amongst professional gentlemen and others. I recollect that part of the canal was drained some time ago, in consequence of a man having been drowned in it. The canal-water is subject to the usual nuisances abounding in towns. That tends to make the water impure. I have not calculated the expense of drawing the water from the eleventh and twelfth lock. There is no such thing in nature as perfectly pure water. There is mineral matter in the water in the eleventh and twelfth lock. I have never analyzed either the canal-water or the water from the Vartry. Dr. Corrigan is a man of eminence in his profession. I was informed by a number of persons that it was from the first cylinder that Dr. Corrigan took his samples. One of the persons who so informed me was a Mr. Nunn.

Gerald Fitz Gibbon, Esq., examined by Mr. JOHNSON.

I am a Master in Chancery in Dublin. I have been a serjeant-at-law. Since March, 1830, I have been a householder in Dublin. I sank a pump in the rear of my house, in order to supply water to my bath. We have to go 70 feet down for water; but I found a pump on my premises which I made use of. I did not obtain the spring water in order to avoid the canal-water, but I prefer the spring water myself. My opinion of the canal-water in both the canals is, that it is a good, wholesome water, although I think that the place from which it is supplied to the city is not the best from which to obtain it. It might be obtained from another place, and it might be rendered perfectly pure. I produce a specimen of the pipe water at the back of my kitchen grate. That is filtered before it goes into the boiler. I also produce a specimen of the spring water, not boiled, but filtered. These specimens were taken yesterday. I produce samples of the pipe water, and also of the spring water taken a fortnight ago. I also produce a sample of the water as it comes in from the canal basin, and before it enters the cistern. Some of these are specimens of the water, with which I have been continuously supplied for a period of thirty-one years. Some of the specimens exhibited here by former witnesses, are no more specimens of the water supplied to Dublin, than specimens taken at London Bridge would be fair specimens of the water which flows past Henley-on-Thames. [The witness here exhibited a plan showing the direction in which the canals run.] The water which supplies the harbour carries off the impurities into the sea. The harbour water is not the water which supplies the city. My cistern was not cleaned for nine years, but when I opened it, I found it perfectly free from impurities. It is a cast-iron cistern, with a division in the centre. The medium for filtration in it is common gravel. It is 8 feet long, 2 feet wide, and 6 feet wide. It is my own design, and I find it quite perfect for the purpose. It is one, the principle of which is easily applied to the water from the canals. Although water had been passing through it for nine years, it was perfectly free from contamination. I have heard of what has been said here about spongillæ. I am perfectly well acquainted with the water in the canals, and think that at the higher level it is as admirable a source from which to obtain a supply as a city could desire. At that level, the water runs along at a very rapid rate. The water which supplies the basin is not transparent, but the higher up you go, as level after level you pass, the purer and more pellucid does it become. With the exception of Dr. Corrigan, every medical man in Dublin thinks it an excellent water. Fourteen of the most eminent medical men in Dublin have signed a document to that effect. The canal-water will never fail in its abundant supply. It always flows over the gates. The corporation might make the supply from that source available at the highest levels of the city in abundant quantities. The recital of the present bill is in direct contradiction to the recital of the bill of 1845, and yet nothing has occurred since 1845 in regard to the supply, to cause that contradiction to be made. I oppose the present bill altogether on public grounds. I believe the Vartry will not afford a sufficient supply for the city. I also believe that the canal-water is amply sufficient for that supply. I always believed that, but I am still more strongly confirmed in that opinion since I read the evidence of Mr. Bateman and Professor Galbraith. My own taxes are 7s. and a fraction, but the average of the taxes is 6s. 5d. They have attained a maximum of 7s. 6d. The assessment is on the valuation.

Cross-examined by Mr. CALVERT: The assessment is not on the real value. My house would let for £150. I am assessed at £136. I do not know that the assessment is two-thirds of the actual value. It is very uneven. The corporation raise an improvement-rate of 2s. in the pound. I also pay a water-rate of 3d. in the pound. A house valued at £80 pays 30s. water-rate per annum. Many houses have a much larger cistern than I have. I have been up the canal four miles. The depth of the water there is 7 feet. The inclination of the declivity is about half a right angle. I am against the supply from Ballysmuttan, or any of the other sources mentioned here. I think the Ballysmuttan scheme is extravagantly too dear. I think the supply from the canals amply sufficient, in point of quality and quantity. I should not like a water that, for seven months in the year, was of a brownish colour. In August, 1842, I visited the Vartry. I believe the reservoir from the Vartry would be sometimes flooded with water, and that great portions of it would pass away. That would be the case in August. The population of Dublin averages about eleven persons to each house. I think the Vartry scheme will cost £1,000,000, and that that is an underestimate. I ground my opinion upon the cost of the Liverpool scheme. I have expressed that opinion in a a pamphlet I published on the subject of the Vartry. I thought the Coyford a very wild and extravagant scheme. The millers opposed that scheme. They might not have opposed it if they had been offered a money, instead of a water, compensation.

Re-examined by Mr. JOHNSON: I have read Mr. Bateman's estimate, to the effect that the cost of the Vartry scheme would be £58,000 more than Mr. Hawksley has calculated. I agree in that, but still think that the scheme would cost £1,000,000. If you go to the Vartry, you must pay the money, and the interest thereon, whether you get the article or not. I only know but one manure-boat on the Grand Canal.

By the CHAIRMAN: I am decidedly in favour of an improved supply for Dublin, and that we ought not to take our supply from low levels.

Mr. *Hemans*, examined by O'MALLEY.

I am consulting engineer to the Midland Great Western Railway, and have constructed the whole of their lines, and other lines. The works of the railway were partly carried on on the banks of the canal. The source of the canal is Lough Owel, where the water is transparent and beautifully clear. You can see to an immense depth—to the bottom. The Rathwire River comes into the canal, at a lower level. That river is occasionally coloured. It is soft. I have been about twenty-one years in and out of Dublin. I have used pipe water all that time. Occasionally, it has not been so clear as one could wish; but, generally, I could not discern any defects in it. The canal-water overflows all the lock-gates, and is in constant motion. The general course of it is running water. It passes through the wheels of the mills. A branch of it supplies the harbour, and at the end of that branch

it becomes stagnant. With that exception, it is a perfectly sound water. All the commercial business of Dublin is transacted in the harbour, and the Liffey communicates with the sea. There is no manure taken on board the barges until after the water has passed the city level. Manure does not leak out of those barges. Very strict orders have been issued not to throw any filth into the canal, and I never saw any thrown into it. There is no drainage or sewerage into it, neither is there any vegetative growth nor contamination in it. Cattle cannot enter the canal-water. I have never seen any flocks of ducks or geese on it. There is a fine imposed, under the Act, on any one who injures the water, or renders it prejudicial to health. There is an embankment at Lough Owel for storing the water. The canal is kept clear of weeds. That is necessary, for the purposes of the navigation. I cannot say whether Mr. Bateman's and Mr. Hawksley's estimates are correct. I think the best scheme would be an improved supply from the canals. There is an objection to bringing water from the mountains through pipes and conduits.

Cross-examined by Mr. MONK: Lough Owel is fifty miles from Dublin. Its elevation is 300 feet above the level of the sea. It supplies the Royal Canal only. The canal communicates with the Shannon and the Liffey. The reservoir at Lough Owel contains 2500 acres. The drainage ground there is 5100 acres, if you take away the area of the reservoir. It would not be difficult to take the water from Lough Owel for the supply of Dublin. The water along the canal now passes through some considerable portion of bog. The bog contains peat, and the turf from there is put into the barges. The town of Kilcock is three or four miles from the canal. I am certain it is not on its banks. The water of the Rathwire is of a coffee colour; but it loses that colour when it becomes intermixed with the canal-water. Mr. Hassard is an engineer of great eminence. He is an assistant of mine, and he has recommended the Vartry scheme. I believe the canal-water has been misrepresented here; but still I am not going to say that it is the best source of supply for Dublin. I hold the highest possible opinion of Mr. Bateman. I am not exactly aware that he has estimated his scheme at £295,000. The canal-water runs rapidly when the mills are going, and when the water is running over the gates. It runs about a mile in three hours. It takes about six days for the water to run from Lough Owel to Dublin. I know it has been said here that the water is stagnant. The canal is about 35 feet in breadth, and perhaps the average depth of it is about 5 feet. As the canal approaches Dublin, it becomes scummy on the surface, and very impure. There is a bone manufactory on the banks, but I do not believe the refuse from there flows into the canal. I have never seen any bilge-water pumped out of the barges. I have never seen the bilge-water passed through a shoot from the barge over the bank of the canal. The barges on the canal are about fifty a week, or seven a day.

Re-examined by Mr. O'MALLEY: Mr. Hassard preferred the canals, on the ground of cheapness. He was anxious to be called, but was not called. The Irish canals are larger than those in England, and they contain very pure water, with very little traffic on them. I am aware that a great portion of the City of London is supplied from the Thames, and that the town of Reading is on its banks. I am not aware that there are any bye-laws to prevent impurities from being thrown into the Thames. In ascertaining the velocity of the canals, I used a fair simple test, at the time when there was little wind and no flood.

This closed the case on the part of all the petitioners.

Mr. *George Perrin* (one of the commissioners of Kingstown) wished to correct a statement made, relative to those commissioners. He said: It was stated, by Dr. Gray and others, that the Kingstown commissioners were consenting parties to the Vartry scheme, in consequence of an arrangement come to between them and the corporation.

Mr. CALVERT denied that any such statement had been made by Dr. Gray, and referred to the short-hand writer's notes on the subject.

Mr. *Perrin* said that nothing had been done by the commissioners which could justify Dr. Gray, or anybody else, in making the statement.

Mr. CALVERT then proceeded to reply on the part of the promoters. He said that he never rose to address a committee on a question of this nature with a greater feeling of anxiety than he did at the present moment, because, if the corporation were wrong, what were they to do? When men united to establish water-works, they generally consulted a good engineer. That had been done here, for they had procured the services of Mr. Hawksley. Then, if a controversy arose, an arbitrator was usually called in. That also had been done here, and it was done in a way most likely to produce a successful result, for they had applied to Government on the subject, and a gentleman of undoubted, first-rate respectability had been sent. The corporation had, in fact, devoted ten years of unceasing inquiry to it; and in what result was all their labour now to terminate? There had been the greatest possible anxiety evinced, on their part, to avoid expense. The very reference to the royal commissioner had been made with the view of avoiding expense. There had been no partiality evinced. There was not one single member of the corporation who was supposed to have the slightest interest in the Vartry scheme. Mr. Hawksley had no interest in it, his simple object being to obtain the best and most economical supply. If, then, the corporation were wrong, what were they to do? Should they set up the Ballysmuttan scheme? Why, the eminent engineer who had been examined in favour of that scheme, admitted that it was not the best. Were they to have recourse to the canals? Why, the engineer examined in favour of them would not go the length of saying that they were the best. The corporation were opposed by persons who would not abide by the alternatives they offered; and, if the promoters were not now offering the best scheme for the administration of the water supply of Dublin, they were left without any clue to it. What could they do more than they had done—namely, select the most eminent engineer, select a referee of the highest eminence, investigate the whole subject thoroughly, in all its branches, and, with the assistance of their advisers, adopt a scheme in which not one member of the corporation had a tittle of personal interest. It would be the most disappointing and disheartening event if, on this occasion, having gone so fairly and openly to work, they should not be able to persuade the committee that the system which they had recommended was, in truth, the right system for the supply of the city of Dublin. His learned friend, Mr. Hope Scott, said that time was not pressing; but this was a great mistake. The arrangement with the canal companies would terminate in five years; it would take at least four years to carry out works such as those proposed by the present bill, so that, instead of being too soon in applying for their bill, the corporation were on the very verge of the time when, in order to carry out any new system for the improvement of the present supply, they should obtain their Act of Parliament. It was to be regretted that this scheme was not settled last year. The corporation had made every exertion to effect that object, but the same parties who now opposed them pursued the same course last year, with respect both to the Coyford scheme and a project which had been devised for obtaining water from the two canals. In consequence of that opposition, the corporation were disappointed in their expectation of having the water question definitively settled during the last session, and they were obliged to look for a new source of supply. The present scheme came before the committee, recommended by an eminent engineer—the royal commissioner—who had no personal interest in the question, and whose sole object was to discover the best and most satisfactory scheme. The corporation felt themselves bound to carry out his recommendation, having been fortified by the advice of their consulting engineer, that the water of the Vartry was the best that could be procured, and that the works could be carried out for the sum named—viz., £300,000. But, the same parties who thwarted and defeated them last year, came forward to oppose them now, and they did so under the most extraordinary circumstances; for, whilst the promoters had conducted their case in such a manner as to elicit truth, their opponents had framed their petition in such a manner as to leave them up to the moment Sir W. Alexander rose to address the committee, in perfect ignorance of the alternative which they meant to propose. In fact, the course they had adopted was more like that which would be taken by a subtle, clever advocate, whose only object was to defeat his opponent, than the candid, honest, straightforward conduct of men who sincerely desired to arrive at the truth, and to discover the scheme which would be the most beneficial to the citizens of Dublin. In fact, this opposition was a mere attempt, on the part of the canals, to defeat the bill, in the hope that, as the time within which the corporation could construct new works was rapidly passing away, the citizens of Dublin would be ultimately left at their mercy. That this was the real object of the opposition, he thought there could be no doubt, when he found that the canal companies had subscribed largely to the opposition fund, and that the principal contributors to it were holders of canal stock. At all events, it gave an air of distrust to the whole proceeding, which he was sorry to see introduced into a question of such paramount importance to all classes of the inhabitants of Dublin. It had been stated in evidence, that the petition against the bill was signed by many respectable citizens of Dublin, not for the purpose of expressing their hostility to the measure, but in order that it might fairly be investigated before the committee. Considering the circumstances of the city of Dublin, and the fact that men of one set of political opinions were likely to oppose any project put forward by men holding opposite opinions, he thought it was wonderful that the petition had not been more numerously signed. The corporation, which was composed of men of various shades of politics, were almost unanimously in favour of the project; in fact, when a division was taken on the question, only four members were found to be opposed to it, and two of these were clearly open to the suspicion of being influenced by interested motives. Sir Edward Grogan, whose name was on the back of the bill, had thought proper to state that he considered the promoters had not kept with him, because provision was made by the bill for the supply of the extra-municipal districts; but he apprehended that Sir Edward had failed to show that the slightest breach of faith had been committed towards him. Dr. Gray, Alderman Roe, and other active promoters of the bill, would be examined, and would show that there had been no breach of faith whatever; and that, from the moment the Vartry scheme was put forward, it was distinctly stated, and well understood, that the supply of the extra-municipal districts was contemplated. He deeply regretted to say, that one of the promoters, who had been examined before the committee, at an early stage of the proceedings, had a few days ago departed this life. The late Alderman Kinahan was deeply interested in this particular scheme. He was a Conservative in politics, but that did not prevent him uniting with the other members of the corporation, opposed to him in political opinion, in endeavouring to secure for his fellow-citizens that great element of health and comfort—an ample supply of pure water. Alderman Kinahan came over to London in bad health to support the Vartry scheme, and, to the sorrow of his friends and the misfortune of his native city, he had fallen a victim to his exertions; but he (Mr. Calvert) hoped that the great work which that gentleman could not have the happiness of seeing consummated during his life, would be carried out successfully after his death. The learned gentleman having briefly referred to the correspondence which had passed between the water-works committee and the canal companies, in order to show that the latter would not give a definite reply to the demand of the committee for a guaranteed and preferential supply of a specified quantity of water, proceeded to say that a great deal had been made of the circumstance that Mr. Hawksley had recommended other schemes. He apprehended that Mr. Hawksley had explained this apparent inconsistency to the perfect satisfaction of the committee. From the first, he was in favour of the Vartry. He pronounced it the best, the purest, and the most desirable water for the supply of Dublin; but he did not recommend it to the corporation, because the expense of procuring water from that source would be greater than the sum to which the corporation had limited him. In their desire to avoid expense, the corporation had limited their engineers in the selection of a source of supply, to a project which would not cost more than £200,000. They afterwards extended the sum to £250,000; and, finally, under the circumstances with which the committee were familiar, to £300,000. It was entirely on pecuniary grounds that Mr. Hawksley recommended any other scheme than the Vartry; and, when the corporation consented to expend £300,000 on the works, he at once advised them that they should adopt the Vartry as the best source of supply. The course Mr. Hawksley had pursued in this matter was so plain and intelligible, that it was unnecessary to comment further upon it. He would not detain the committee by adverting in detail to the various schemes which, from time to time, were proposed for the supply of Dublin with water. In the course of the present inquiry, there had been a suggestion thrown out that the city might be fully supplied from the puddle. The only person produced in support of that suggestion was a sexton; and, whether the sexton buried the puddle, or the puddle buried the sexton, was a matter of perfect indifference to the citizens of Dublin. (Laughter.) The only scheme which had been really put forward by the opposition was the project of Mr. Bateman, for supplying water from the Liffey at Ballysmuttan. He would show the committee that this was not a project which ought to be adopted in preference to the Vartry. The water at Ballysmuttan was highly-coloured with peat, and was frequently of a deep brown colour. That alone was a sufficient objection to the project, for it would be in the highest degree unwise to supply the citizens of Dublin with coloured water. Even if it were not unwholesome, its appearance would create a strong feeling of dissatisfaction. Mr. Bateman admitted that a coloured water was most objectionable, but he said there was a mode by which the brown could be separated from the pure water, and that a sufficient quantity of the latter could be obtained from the river to supply the city, and fill the reservoir. He admitted that during seven months in the year, from the 1st of May, to the 1st of December, the water was highly coloured and unfit for use. During the other five months, he said that the water would be colourless, and that, together with its tributaries, the river would then yield a sufficient supply. But, if there were heavy rains accompanied with heat in the month of April, the water would be discoloured in one of the very months in which he relied for the supply of pure water. When pressed in cross-examination on this point, Mr. Bateman abandoned the principle of his scheme, namely, that water perfectly

pure could be obtained during the five consecutive months, and said he would take any five months he could find in which the water was not discoloured. The learned counsel having quoted Mr. Bateman's evidence in cross-examination on this point, contended that a scheme which was founded on the principle advanced by Mr. Bateman, a scheme depending so much on the state of the weather at a particular period of the year, was not a project that could be safely adopted for the supply of such a city as Dublin. It was a principle that had never been adopted on any previous occasion for the supply of a community with water, and he submitted that the committee would be slow to recommend its adoption in the case of Dublin. There was also this great peculiarity about the Ballysmuttan scheme. Who would adopt it? The committee naturally asked his learned friend, Mr. Hannen, whether he would bind himself to adopt this scheme, and Mr. Hannen, very modestly and with the discretion of a wise junior, said it would be better to wait for an answer to that question until his leader had returned to the room. Well, Sir William Alexander came in, but he never told the committee that his clients were prepared to adopt the Ballysmuttan scheme. It was all very well to fly it as a kite, to allow it to pass for the day, but where were the men who would say that it ought to be carried out? Mr. Bateman himself, who was the originator of the scheme, did not venture to say that it was the best. In fact, it was a scheme laid before the committee at the suggestion of the canal companies to defeat the present bill, in order that the city of Dublin might be left at the mercy of the canals. They had used Ballysmuttan to defeat the Vartry, as they would have used the Vartry to defeat Ballysmuttan. The committee had had the great advocate of the canals before them that day, he alluded to Master Fitz Gibbon, who told them that he objected to every scheme for the supply of Dublin, except the canals. He objected to the Vartry, he objected to Ballysmuttan, he objected—

Mr. JOHNSON interrupted the learned counsel, and said there was no foundation for the assertion that the canals were setting up the Ballysmuttan scheme.

Mr. CALVERT said he had the list of subscribers to the opposition fund; and he found that the canal companies had subscribed £200 to defeat the bill; and, if his learned friend meant to say they were not responsible for the course taken by their counsel, and for the witnesses they had produced, he should like to know who was responsible. They had chosen to subscribe to the ratepayers' petition. They were represented by the counsel who appeared for the opposition committee; they would take the benefit of that opposition, and it was impossible, therefore, to come to any other conclusion than this—that they had put forward the Ballysmuttan to destroy the Vartry scheme, in order that ultimately they might have the supply of Dublin in their own hands. The Ballysmuttan scheme was not brought forward by persons who would be prepared to support it next year. It was thrown before the committee to take chance of the impression it might make, as against the Vartry scheme; but there was no intention on the part of the opposition to bring it forward as an independent scheme at any future period. He was not surprised that his learned friend should endeavour to exculpate the canal companies from the imputation of participating in such a course of conduct. He felt that his clients had placed themselves in a very false and objectionable position, and he could not succeed in extricating them from it, or relieving them from the consequences of their own acts. If the canal companies had come forward with a distinct and definite scheme—if the opposition committee had proposed any project by which they were prepared to abide, then, indeed, they would have had an opportunity of fully discussing the different schemes; but it was a cruel thing towards the inhabitants of Dublin that these parties should come forward, on the one hand, to prevent them having a supply of water from the Vartry, by showing that the Ballysmuttan scheme was better; whilst, on the other hand, they would not pledge themselves to have the Ballysmuttan scheme brought forward on a subsequent occasion. In saying that, he was an advocate for the Ballysmuttan scheme, Sir W. Alexander was merely using it as a weapon of war against the bill, with no sincere intention of having it carried into operation. The committee should recollect that it was responsibility which gave its value to evidence. It was one thing to come forward, as Mr. Bateman had done, to prove estimates, but it was another thing to look forward to a particular plan being carried out, and to the time when it might be said, "Sir, you recommended a scheme which has proved a failure; your catchment basin does not yield a sufficient supply, and the water is bad." Mr. Bateman had no such fear when he came forward to advocate the Ballysmuttan scheme. He did not expect to be called on to carry it into operation, and, indeed, he declined to say that it was the best that could be devised. On the other hand, Mr. Hawksley came forward, and pledged his reputation that the Vartry project was a good one; he was ready to-morrow to construct the works; he declared that the water was excellent, and that the supply would be adequate. The one was, in point of fact, under the greatest possible feeling of responsibility, with the knowledge that his reputation was at stake, and that it would suffer if Dublin turned out to be badly supplied by the system he recommended. The other merely flew a kite, and put forward a project about which nobody would ever think again. Five or six years hence, it would be forgotten; but it would not be so as to Mr. Hawksley, if he were wrong in recommending the people of Dublin to spend £300,000 on a system of water supply, which should happen to turn out to be a mistake. In every department of life, it was principally responsibility that made all the difference in men's actions; and, therefore, every word Mr. Hawksley uttered, he uttered under the deep feeling that he was responsible for the accuracy of his statement. Mr. Bateman, at best, if he defeated the bill, would be applauded for his dexterity. If the bill were thrown out, what gentlemen would come forward and subscribe out of their own pockets to promote a measure, even of such public advantage, when they were liable to be met with opposition of that character? He very much feared, if the bill were lost, that the citizens of Dublin would be for ever deprived of an improved supply of water, and left wholly dependent on the canals. Another witness had been produced on behalf of the petition, Professor Galbraith, who was said to be indifferent between the various schemes, yet it was remarkable that he had supported a resolution proposing to take the water of the canals. He (Mr. Calvert) would not enter into an investigation as to how that distinguished person had signed such a resolution, and then stated he had no preference for any particular scheme. No doubt, he was a man of great ability; but men of great ability were liable to be mistaken, as he thought he would satisfy the committee Professor Galbraith was. It was a curious fact in the case that four other distinguished engineers had been produced, who stated that Mr. Hawksley's plan was right. Where was the engineer who supported Mr. Bateman, founded on the principle of saving water five months in the year? Mr. Bateman had been engaged for Lord Downshire, and had surveyed the district in which Ballysmuttan was situated, and he imbibed, naturally, a leaning for the scheme. Mr. Hawksley, on the contrary, was perfectly indifferent, and the greater responsibility would attach to him hereafter, if the scheme which he selected turned out to be a failure. The district he selected was one with which he was totally unconnected, and in which he had no personal interest. It was true that, at one time, under the particular circumstances stated, he had reported in favour of the Ballysmuttan scheme, but at that time he was under the impression that the water could be rendered colourless. Subsequent experience, however, satisfied him that that could not be practically effected, so as to make the supply available for such a city as Dublin. The great advocate of the canals, Master Fitz Gibbon, had been examined. He objected to the Ballysmuttan scheme, as much as to the Vartry scheme, and contended that the canals were the proper source from which the water should be drawn. He entertained some extraordinary opinions as to the Vartry scheme, for he thought it would involve the expenditure of more than a million of money, whereas Mr. Bateman's estimate was only about 5 per cent. more than Mr. Hawksley's. The extraordinary idea of Master Fitz Gibbon showed how he was deluded on the subject; and, under that delusion, he had been circulating groundless statements, calculated to produce prejudice in the minds of the citizens of Dublin. The promoters had been asked why they had not called Mr. Hassard, but it should be recollected that he was an assistant of Mr. Hemans, an engineer of the Royal Canal. It would be an act of madness to call him, as he would come out of the enemy's camp. Besides, he never applied to be examined as a witness, and could not indeed have made such an application, except with a smiling countenance as a joke. Under these circumstances, the committee could not be surprised that Mr. Hassard was not called.

WEDNESDAY, MAY 8.

Mr. CALVERT resumed his address. He said that he had been discussing the Ballysmuttan scheme the previous evening, and that he had only now to add, with respect to that, that it was not adopted by any party. The opposition committee did not pledge themselves to carry it out. Mr. Bateman would not say it was the best, and Mr. Hemans did not approve of it. Under these circumstances, it could not be looked upon with favour by the committee. The only other scheme which had been brought forward by the opponents was the canal scheme, as to which, he thought, an answer given yesterday was conclusive. The committee should recollect that there was scarcely a great town in England that was not approached by one or two canals, and that mints of money might have been saved, if the water used by those towns were obtained from those canals. The question was put to the only engineer, who was examined yesterday, and he said he did not know a single town in England which was supplied with water from a canal. Why? Because canal-water was of such a character that the towns would spend thousands, nay millions, in order to obtain their supply from a purer source. He might almost rest his case on that answer of Mr. Hemans. At the same time, the committee should recollect that the corporation could never obtain from the canal companies a definite answer that they were prepared to supply the required quantity, and to make that supply guaranteed and preferential. The reason of this was plain. The duty of the canal companies was, first, to bring barges to Dublin, and afterwards to supply a certain amount of water to the docks; and, when they had discharged these duties, they could not undertake to supply the city with the quantity which was essential. They had not water enough, and, if they had, they had an opportunity, from year to year, of entering into a fixed and definite engagement with the corporation on the subject; but they had never done so. A great deal had been said about the impurity of the water of the canal; but, at the close of the inquiry, he found that the case was much worse than even he had at first supposed. There could be no doubt, after the evidence which had been given, that the water was not fit for human use. Mr. Hemans—a most truthful witness—stated that every possible precaution had been taken to prevent cattle from getting into the canals, or flocks of ducks and geese swimming in it, and bilge-water being pumped into it. He (Mr. Calvert) was willing to believe that the water was given to the city as pure as could be given under the circumstances; but the actual condition of the water, notwithstanding all those precautions, had been shown to the committee. The water was not stagnant—no water through which barges continually passed could be altogether stagnant—but it was, at best, almost stagnant. Weeds grew perpendicularly in it, which could not be the case if there was anything like rapid motion in the water. Some of the witnesses produced, on both sides, stated that they had filters in their houses, and that filters were in very general use among the respectable inhabitants of Dublin, which would not be the case if the water supplied were pure. Master Fitz Gibbon had produced some very beautiful unfiltered water, but the committee would recollect the state of the weather at present. Some people were sufficiently deluded as to look on the month of May as a warm month. For his part, he regarded May as the gayest deceiver in London, and as the most disagreeable month in the year. Water taken in the early part of the month of May did not fairly represent the water as it was to be found when the vegetation in the canals rotted and decomposed in the autumn. It should be recollected that the canals, with a depth of 5 feet, were exposed for sixty miles to the influence of the climate, the necessary consequence of which was that it became warm, the temperature rising, as one of the witnesses had stated, to 68 degrees, and the committee would recollect that it was 70 degrees of temperature which produced the abominable state of the Thames water that was so much complained of a few years ago. It was not to be supposed that, because the Thames water forced its way into London as a water supply, that the canal-water was, therefore, fit for the people of Dublin. The Thames water used in London was taken at a point above Thames Ditton, and for years the course had to go further and further away from the city. The learned counsel then read the analysis of the canal-water as given in evidence, and contended that it was conclusive, as showing the bad quality of the water. Under these circumstances, he thought the committee would at once come to the conclusion that the adoption of the canal scheme was altogether out of the question. As to the Ballysmuttan scheme, and the Dodder scheme, he hoped he had satisfied them that they were not to be thought of either. What, then, were they to do? In the words of Sir Edward Grogan,—"If we do not get water from the Vartry, I do not know where we shall get it." The district of the Vartry was admittedly most admirably suited for a water supply. The formation was of granite and clay slate; there were no mineral beds, the stream flowed rapidly, the water was pure, and Mr. Bateman admitted that it did not sink sufficiently deep into the soil to acquire any taste therefrom, in consequence of which, he pronounced it to be vapid. This point was one of some importance when the committee came to consider the question of loss by evaporation and absorption. The Vartry scheme came before the committee on the recommendation of the royal commissioner, Mr. Hawkshaw, who had come to that conclusion, after a careful inspection of the district, and an examination of all the other projects. He was assisted by estimates prepared under his direction by Mr. Hawksley, and Mr. Neville; and, therefore, it could not be said that he had reported in favour of the Vartry without having had ample information on the subject. The questions, then, for the consideration of the committee were, the quality, the quantity, and the pressure of

the water to be obtained from the Vartry. The pressure was admittedly sufficient; the quality admirable, the water being soft, pure and colourless. The latter was a point of great importance, for the citizens of Dublin had hitherto been in the habit of using a colourless water, however objectionable it might be in other respects. It would, therefore, produce great discontent and dissatisfaction, if the water supplied to them under the new system were coloured with peat, and in this respect the Vartry had an acknowledged superiority over the Ballysmuttan scheme. With respect to the quantity, if that were to be determined by gauges, a very long period of years was indispensable. Sir W. Alexander asked Mr. Hawksley whether gauges should not be taken for three years. What was his reply? Mr. Hawksley said that in his opinion, the results of the gauges for twenty years were necessary to enable him to come to a safe conclusion. Who was right?—the gentleman who instructed Sir W. Alexander to ask that question, or Mr. Hawksley, who showed by his answer the habitual caution which he exercised in questions of this nature? What was the fact with respect to rain-gauges? There had been no rain-gauges in the Vartry, in the Ballysmuttan, or in any other district in the neighbourhood of Dublin for so long a period, that if the citizens were to wait until they could make satisfactory calculations from rain-gauges, the city would be a long time indeed, without an improved supply. However, by means of rain-gauges at Dublin and at Fassero, and taking the driest years at those places, Mr. Hawksley had been able to make an accurate estimate of the quantity of rainfall in the Vartry district in the driest years. Not having had rain-gauges on the Vartry the question resolved into this—what was to be done? Eminent engineers had been called and examined, and they confirmed the accuracy of Mr. Hawksley's calculations, by which it appeared that an ample supply of water would be yielded by the Vartry basin. Mr. Hawksley's rule for the calculation of rainfall was founded on very long experience, and the results showed that it was perfectly reliable. He took the proximate gauge to the district, the rainfall of which was to be calculated, and added 2½ per cent. for every 100 feet of elevation. In comparing the results obtained by this rule at one locality with those obtained at another place, Mr. Hawksley stated that regard must be had to similarity of position, aspect, and the height of the surrounding hills. Bearing this in mind, the cases which Mr. Bateman had cited, with respect to the Scotch hills, and the Cumberland Lake district, and the east coast of England, are altogether inapplicable to the Vartry, which was not similarly situated. He repeated that the question was—not having rain-gauges in the Vartry, what was to be done? Mr. Hawksley had applied a formula, which past experience and observation had satisfied him was correct; and engineers of great eminence had been examined, who more than confirmed his opinion. Mr. Simpson, an engineer of the highest eminence, had stated that Mr. Hawksley's rule gave results not too large, but too small; and it was remarkable, that Mr. Bateman in his evidence before the royal commissioner, made the same remark; for he complained that Mr. Hawksley's rule, when applied to the Ballysmuttan scheme, gave results which were too little. In one instance, the application of the formula to the Ballysmuttan district gave 19 inches, whilst the actual rainfall was 27·65, and the actual rainfall on the Seafin Mountain was one-tenth part greater than Mr. Hawksley's calculation. Mr. Glaisher, a scientific man, a Fellow of the Royal Society, and secretary to the Meteorological Association—a gentleman, with regard to whom it was impossible to suggest that he had any interest in the matter, and who obtained all his information by direction of the Government—had tested the accuracy of Mr. Hawksley's formula, and, having done so, he pronounced that the principle on which it was founded was correct, but that, in all instances, the results given by it were too small—that it was not a philosophic, but an engineering formula, and that it was such as the committee might safely and practically act upon. Sir John Benson, an eminent and experienced engineer, approved of Mr. Hawksley's rule; and Mr. Neville had also approved of it. Its accuracy was confirmed by Mr. Simpson, and Mr. Glaisher; and, under these circumstances, there could be no danger in acting upon it. A comparison of the rain-gauges at Ballysmuttan, Fassero, and the Vartry, showed that the rainfall was greater at Fassero than at Ballysmuttan, and greater at the Vartry than at Fassero.

Mr. WEBB said he was sorry to interrupt the learned counsel; but the fact was, that the returns showed that the rainfall at each place was exactly alike,

Mr. CALVERT: The returns show an excess in favour of the Vartry district.

Mr. WEBB said that that was because they included one day more, and that if that day were deducted they would have the exact quantity.

Mr. CALVERT: I rely on the returns handed in by you in support of my assertion.

A long discussion ensued between the counsel on both sides, as to the particular returns from which the learned counsel was reading. At the close of it,

Mr. CALVERT proceeded to say that, he was quoting from the returns handed in by Mr. Bateman and Professor Galbraith; which, when added together, gave the results for one year. He had returns from January in the present year, and returns from April, 1860, to December, 1860. Surely, he had a right to add these together.

Mr. WESTHEAD: You obtained from a document, which Mr. Galbraith handed in yesterday, the returns of the rainfall from January to March of the present year, and the paper, previously given in, gave the returns from April to December last year. The items which you are putting before us are the results of these two returns when added together.

Mr. CALVERT: Exactly so. The result was, that the Ballysmuttan gauge gave a rainfall of 58 inches for the year, and the Fassero gauge for the same, 62·49 inches. The Fassero gauge for three months—namely, from the 2nd of January to the 3rd of April, 1861, gave 21·93 inches. He would now call two witnesses whose evidence ought to be conclusive upon the subject. Mr. Bateman said, in his evidence before the royal commissioner, that he had a right to calculate on a rainfall of 50 per cent. more at Ballysmuttan than in Dublin. If Mr. Bateman had a right to calculate on an increase of 50 per cent. with respect to Ballysmuttan, Mr. Hawksley had an equal right to calculate on a similar increase in the Vartry district. Applying that principle to Ballysmuttan and the Vartry—the gauge in Dublin showing a fall of 22 inches—the result would be a fall of 33 inches in both places, and this was another indication that the committee would be perfectly safe in adopting the Vartry as a source of supply. Then, they had the evidence of Master Fitz Gibbon, who told them that the floods in the Vartry, during the six months commencing on the 1st of August, were so great that no reservoir could be constructed that would be able to contain them. If this were so, what became of the extraordinary theory of winds which had been advanced by Mr. Bateman and Professor Galbraith, to show that very little rain would be deposited in the Vartry catchment? It was a strange thing to hear that in Ireland, of all places in the world, there was not enough of rain; but, to his own astonishment, he found himself compelled to argue that there was. Mr. Bateman stated that, in five months out of the twelve, he could collect 3000 million gallons at Ballysmuttan; and yet he also stated that, in the Vartry district, in the entire year, there could not be collected 2000 million gallons. That Mr. Bateman was not an impartial and unbiassed witness, was, he submitted, proved by statements that, in all Ireland, there could not be selected a drier district than the Vartry. He would prove, by the confession of the witnesses produced by the opposition, that the Vartry would yield a sufficient supply. By the calculation of Professor Galbraith, there would be 11 inches of rainfall in the Vartry; by Mr. Bateman, 12 inches. Eleven inches would yield 10 million gallons per day, which would give 25 gallons of water per day to 400,000 people. In Manchester, a great manufacturing town, the supply was only 21 gallons per head a day. In Dublin, by the admission of the witnesses against the bill, there would be 25; and, inasmuch as manufactures followed coal and iron, there was, he feared, no expectation of Dublin becoming a great manufacturing city. The supply, therefore, was more than sufficient. Master Fitz Gibbon was of opinion that ten gallons per head a day would be sufficient for the supply of the inhabitants of Dublin; but, at the lowest calculation by the opponents of the bill, the Vartry would yield 25 gallons per head. He had hitherto discussed the question without taking the Dodder into account; but it must not be forgotten that the corporation could always calculate, in the driest year, on 1 million gallons per day from that source. With respect to the estimates, he would not trouble the committee. Mr. Bateman's estimate only placed the cost of the works 5 per cent. in excess of the corporation estimates; and it must be remembered that contractors had tendered for the construction of the works, and had stated their readiness to give security to carry them out for the amount stated. The only other point for consideration was, the additional expense for distributory purposes. By the clause, the corporation were tied down, as to the expense, to raise a certain amount of money only for the particular purpose; but, if the committee thought fit, they had no objection to the addition of the words, "Not exceeding a certain sum." If Mr. Bateman came forward and undertook to carry out the works of any particular scheme, there was no man's opinion he would more respect than his.

Mr. WEBB: He offers to do it.

Mr. CALVERT said that that was the safest offer in the world, because he must know that nobody would give him the employment, but how was that offer to be compared with that of men who were responsible for their opinions? A petition in favour of the bill had been signed by 21,000 persons, the petition against it by 1000, and a large number of those who signed the latter did so for the purpose of having the question fairly and fully investigated. The promoters had the evidence in favour of their bill of Dr. Corrigan, President of the College of Physicians; Dr. Apjohn, professor of chemistry to the Dublin University; Professor Sulivan, professor of chemistry to the Museum of Irish Industry; Professor Jukes, the head of the geological survey in Ireland; Dr. Phelan, secretary to the Board of Superintendence of Dublin Hospitals; Dr. Wilde, vice-president of the Irish Academy; Captain Willis, of the Vice-Regal Household; the master of the Coombe Lying-in-Hospital; the chief dispensary physician in Dublin, and the honorary secretary of the Chamber of Commerce; and they were all of opinion that Dublin required an improved supply, and that the best source to take it from was the Vartry. On the engineering question, they had the evidence of Mr. Hawksley, Mr. Neville, Sir John Benson, Mr. Simpson, and Mr. Hawkshaw, the royal commissioner, who had thoroughly and completely investigated the case. With respect to the rainfall, they had the evidence of Mr. Glaisher, Mr. Hawksley, Mr. Simpson, and Mr. Neville, who were all of opinion that the supply from the Vartry would be ample for the requirements of Dublin. On the other side, they had the evidence of Dr. Minchin, who seemed to set great value on pumps in Dublin, and of Master Fitz Gibbon, who talked of floods in the Vartry, but who must be under the influence of some strange hallucination on the subject, when he estimated the cost of the present project at £1,500,000, whilst Mr. Bateman only estimated it at between £300,000 and £400,000. Then, with respect to the Ballysmuttan scheme, as he had already said, Mr. Bateman would not state that it was the best, and Mr. Hemans, the only engineer who was called for the opponents, declined to adopt it. As to the question of time, if the decision of the committee were adverse to the bill, it would be fatal to the improved supply of water to the city, which was admittedly required. Two bills presented by the corporation at their own expense had been defeated last year by the opposition of the canals.

Mr. O'MALLEY: That statement I am compelled to contradict. The canal companies did everything in their power to help you.

Mr. HANNEN also denied the accuracy of the statement.

Mr. CALVERT: The canal companies repudiated their undertaking.

Mr. O'MALLEY: You cannot show that by the evidence.

Mr. CALVERT: Do you not know it to be the case?

Mr. O'MALLEY: Certainly not.

Mr. CALVERT: They said they could not carry out their agreement unless the amalgamation bill was carried. Dr. Gray showed that the undertaking of the canals had not been carried out.

Mr. O'MALLEY: Dr. Gray, on the contrary, stated that the canal company had acted most honourably.

Mr. CALVERT said that Dr. Gray had spoken of the conduct of Mr. Ellis, the chairman of the Midland Great Western Company, who, he admitted, had acted honourably in the matter. But the fact was, that the canal companies had distinctly stated that their offer to supply the water was contingent on the passing of the amalgamation scheme, and that bill having been thrown out, the arrangement fell to the ground. The canal companies were now subscribers to the opposition fund, and there could be no doubt that they were amongst the most determined opponents of the bill. The learned counsel characterized the opposition to the bill as most unscrupulous, and expressed his regret that, in a question of such vital importance to the citizens, such an objectionable course should have been pursued. He trusted the decision of the committee would allow the promoters of the bill to return to Dublin, taking with them that greatest of all boons that could be given to a community—an abundant supply of pure and wholesome water.

The room was then ordered to be cleared. In twenty minutes afterwards, the public were re-admitted, when

The CHAIRMAN said, the committee had unanimously come to a resolution that the preamble of the bill is proved.

[The preamble was as follows:—"That the state of the present supply of water to the city of Dublin is bad, that there is an urgent need of an improved supply, that the best source from which an improved supply can be obtained is the river Vartry.]

The committee then proceeded to consider the clauses of the bill.

The CHAIRMAN handed to Mr. Calvert a clause, which, he said, he had received from the Admiralty; and to which, the learned counsel stated, he would give immediate attention.

Clauses, down to clause 10, which referred to the limits of the Act, extending it to Bray, Kingstown, Rathmines, &c., were agreed to.

Mr. TINDAL ATKINSON opposed clause 10, on the part of the Rathmines town commissioners, and called

Mr. *Frederick Stokes*, chairman of the commissioners, who deposed that the township was abundantly supplied with spring water. The commissioners were 17 to 1 against the extension, and the ratepayers were almost unanimously against it. The rates were 2s. 10d., whilst those of the city were 6s. 4d. The population was 6300 females, and 3700 males. The Improvement Act of 1847 enabled the commissioners to supply water to the township.

Cross-examined by Mr. MONK: The commissioners have never constructed water-works under the Act. They have a powerful fire-engine, and water-carts always filled, to be ready in case a fire broke out. Pumps, and the canal, are the only means of getting water in case of fire. The risk of fire is very trifling, as the houses are all detached. No fire has occurred in Rathmines for sixty years.

Mr. *J. H. Evans* and Mr. *Johnston*, of Leinster Road, were also heard. Their evidence was to a like effect.

The CHAIRMAN (to Mr. Johnston): What is your objection to the clause, when there is no compulsory power in the bill to enable the corporation to compel the ratepayers to take it?

Mr. *Johnston*: There is a strong feeling in Rathmines against the corporation having anything to do with the township.

After some discussion,

The CHAIRMAN: The committee are unanimous in passing the clause, without any amendment.

Clauses down to clause 43 were then agreed to.

THURSDAY, MAY 9.

Mr. BRYDEN, parliamentary agent, resumed his reading of the clauses, and when he came to clause 58, which enabled the corporation to borrow, over and above the sum of £300,000, "such further sums of money from time to time as may become necessary to defray the expenses of extensions," he said that an alteration had been made in this clause. As it now stood, the corporation sought from time to time to borrow on mortgage, and in addition to the debenture debt existing at the time of the passing of the Act, "such further sum or sums of money not exceeding in the whole the sum of £300,000, on the security of the rates leviable under the authority of this Act, as the corporation may from time to time think requisite, and may grant mortgages charged on such rates or any of them: provided always that the interest payable on the existing debentures granted before the passing of this Act, under the said recited Acts, or any of them, shall be charged upon the rates leviable under this Act in the same manner and to the same extent as such existing debentures were charges on the water-rates upon which the same were therefore charged: provided also that the interest on such existing debentures shall be payable in priority to the interest on any moneys borrowed under this Act: provided, also, that the corporation may from time to time extend their distributory and other works and pipes when and as occasion may require, and for such purposes may take up at interest any further sums of money; but any of such further sums of money which may from time to time be required for the purpose of making and extending the distributory and other works and pipes for the supply of the extra-municipal district, or any part thereof, shall be raised only on the security of the income arising or to arise from the supply of the water in the said extra-municipal district: provided further, that the sums of money to be taken up at interest for the extension of the distributing or other works and pipes within the city should not exceed in the whole £24,000, and the sums of money to be taken up at interest for the extension of the distributory and other works and pipes in the extra-municipal districts should not exceed in the whole £75,000." Mr. Bryden stated that, Mr. Massey had required a definite sum to be stated in the clause as the maximum beyond which the corporation could not go. The sum was fixed at £24,000 within the city.

The CHAIRMAN said that was inasmuch as the clause would lead to much discussion, it would be better to reserve the consideration of it until the other clauses were disposed of.

The clauses from 58 to 66 were then passed without opposition.

On clause 67, which empowered the corporation to purchase the property belonging to the Kingstown Water-Works Company, being read,

Mr. SHARKEY, who appeared on behalf of the Kingstown commissioners, objected to this clause in its present form. The corporation sought powers by this clause to purchase the Kingstown Water-Works, and that that company should be empowered to sell to the corporation at such price as should be mutually agreed upon, all the undertaking, and all the powers and authorities vested in the Kingstown Water-Works Company; provided that the corporation should not, without the previous assent of the said company, supply water within the limits of the said Kingstown Water-Works Act of 1859. This clause, he would show, was objected to by the corporation themselves, or their agents. Mr. Bryden had deposited a petition, numerously signed by the inhabitants of Kingstown, in favour of the bill, but objecting to this clause. His (Mr. Sharkey's) objection to the clause was, that it would deprive the Kingstown commissioners of the rights which they had under the Water-Works Act of 1859.

Mr. *George Perrin*, one of the Kingstown commissioners, was examined, and stated that the commissioners had been in favour of the Vartry scheme, on the understanding come to with the promoters that the present bill should preserve their rights under the Kingstown Water-Works Act of 1859. They were of opinion, however, that the 67th clause would deprive them of their rights. It gave power to the corporation to purchase the rights of the Kingstown Water-Works Company, without undertaking any of its liabilities.

Cross-examined by Mr. BARRY: No works had as yet been constructed by the Kingstown Water Company. Mr. Bateman had made certain recommendations which would necessitate an application for an amendment of the Kingstown Water Act. He (Mr. Perrin) thought at one time that the Kingstown Water Company was a myth. Mr. Bateman's evidence had changed his opinion.

Mr. CHAMBERS, J.P., chairman of the town commissioners, was the next witness. He stated that the Kingstown commissioners were anxious to get water from the Vartry on the same terms as they would be entitled to obtain it from the Kingstown Water Company. In its present shape, the clause would cause great dissatisfaction to the inhabitants of Kingstown.

Mr. BARRY, Q.C., said that the Kingstown Water Company had not exercised any of their powers under the Act of 1859. They had not taken any land; and a portion of that which had been intended for their reservoir had been built upon.

The CHAIRMAN: Why, then, have you agreed to give them £5000?

Mr. BARRY: We do so to avoid a parliamentary contest with them.

Mr. *Hawksley* was examined by Mr. BARRY, and stated that the great advantages which the inhabitants of Kingstown would derive from the corporation bill was a constant supply of water at high pressure.

Cross-examined by Mr. SHARKEY: The corporation could not supply Kingstown at a lesser rate than 1s. 3d.

Mr. WYVILL: Under the local Act, the rate was, I believe, 1s.?

Mr. *Hawksley* said that that was the price.

Mr. SHARKEY observed that his clients would adopt any fair terms.

Mr. BARRY said that the corporation would agree to erect six drinking fountains in Kingstown, provided that the water was not sold.

Sir W. GALLWEY: What do you mean by a drinking fountain? Is it a little dribblet of water?

Mr. BARRY: Such as are now in Dublin.

Sir W. GALLWEY: Not large enough to afford a supply for domestic purposes?

Mr. BARRY: No; not so large.

The CHAIRMAN: Let a draft clause be prepared this evening, and submitted to the committee to-morrow.

Mr. HANNEN: The committee will bear in mind that the corporation are trading on the property of the citizens of Dublin, and they should certainly not be taxed in order to confer advantages on Kingstown. In considering the clause to be submitted, regard should be had to the rights of the ratepayers of Dublin.

FRIDAY, MAY 10.

Mr. SHARKEY said that, on the previous evening, the promoters of the bill had submitted a clause, which his clients had much pleasure in accepting, on the terms of the proviso contained in the 67th clause being struck out, which he understood the counsel for the corporation had consented to do.

Mr. BELL (parliamentary agent) objected, on the part of the Kingstown Water-Works Company, to the striking out of this proviso, which provided that the corporation should not, without the previous consent of the said company, supply water within the limits of the Kingstown Water-Works Act of 1859.

Mr. BARRY said that the object of this proviso was to facilitate the corporation in dealing with the Kingstown Water Company, and he feared that its omission would tend to embarrass them. He thought the proviso would not prejudice the Kingstown commissioners in the slightest degree. The corporation had consented to introduce a clause, undertaking, when they supplied water to the inhabitants of Kingstown, to erect six fountains for the supply of the poor.

The CHAIRMAN said the committee were under the impression that the proviso to the 67th clause would have the effect of nullifying the clause which the promoters now consented to introduce; because, if the Kingstown Water Company objected to the erection of fountains for the use of the poor, the corporation would not be able to carry out their undertaking.

Mr. BARRY said that there need be no apprehensions on that account. If the corporation obtained their Act, the Kingstown Company would never proceed with their undertaking, but would sell their rights and privileges to the corporation. On the other hand, he had no doubt that, if the present bill were thrown out in the House of Lords, the Kingstown Company would certainly proceed with their project, and, with that view, they were at present promoting a bill to amend their Act.

The CHAIRMAN stated that the committee were of opinion that the proviso should be retained.

Clause 46, as amended by the promoters, provided that the public water-rate should amount to one-fourth of the domestic water-rate.

Mr. HANNEN said that, it might not be necessary to raise for public purposes one-fourth of the domestic water-rate, and he would, therefore, suggest that the words "not exceeding" one-fourth of the domestic water-rate should be introduced.

The CHAIRMAN asked whether there was any objection to this proposition?

Mr. BARRY said it was desirable that the public water-rate should be fixed, in order to avoid the discussions which would otherwise arise.

Mr. *Hawksley* observed that, if the words "not exceeding one-fourth" were introduced, the public water-rate might be one-fifth or one-sixth of the domestic water-rate. The result would be that there would be a continual contest between two classes, the owners and the occupiers of houses, each endeavouring to reduce the taxation which affected themselves. It was to avoid such a contest that the corporation wished to have the public rate fixed, and they therefore proposed that it should rise or fall in the same ratio as the domestic water-rate, which could not exceed 1s. in the pound.

The committee decided against introducing the words "not exceeding," and the clause stands as proposed.

Clause 58, gives the corporation power, to borrow on mortgage or debenture, £300,000 for the purposes of the Act, and to raise a sum not exceeding £75,000 for the extension of their distributing works in the extra-municipal district.

Mr. GREGORY submitted that words should be introduced into the clause, specifying the purposes to which the £300,000 were to be applied, because otherwise, the corporation would be able to throw this money into the borough fund, and spend it in any way they thought proper.

Mr. BARRY was of opinion that the words Mr. Gregory proposed were wholly unnecessary; but he had no objection to the introduction of a provision that the corporation shall apply the moneys levied under this Act to the purposes of this Act.

The clause, with the words agreed to by Mr. Barry, was adopted.

The clauses proposed by the Admiralty for the protection of the harbour of Wicklow, were then brought under consideration.

Mr. MALLEY (of the Irish bar, instructed by Mr. Mark Toomey) appeared on behalf of the commissioners of the town and harbour of Wicklow. His clients had not opposed the bill on the understanding that they should be indemnified for the expenses which they had incurred in relation to this matter; but the words which provided for the payment of their expenses had been struck out, and he submitted that they should be restricted.

The CHAIRMAN said that the words in question had been struck out by the Admiralty, and it was not in the discretion of the committee to make any alterations in the clause. The learned counsel might, however, propose a separate clause, by which his clients would be indemnified; but the majority of the committee were opposed to the principle of it.

Mr. O'MALLEY observed that, under these considerations, his appearance for the harbour commissioners was not to be taken as an approval by them of the bill.

The CHAIRMAN said that the clauses proposed by the Admiralty were of the most stringent character he had ever seen; and that, whatever deterioration the harbour of Wicklow might undergo, the costs must be borne by the citizens of Dublin.

Mr. *Hawksley* stated that the Admiralty had originally proposed a very simple clause, and they had substituted those very stringent clauses at the instance of the harbour commissioners, who negotiated the whole matter privately with the Admiralty, without any communication with the promoters.

The following are the second and third of the clauses proposed by the Admiralty:—"If the Lord High Admiral, or the said commissioners, shall, at any time, consider the said harbour or channel to have been deteriorated or damaged, or the depth therein lowered to less than the standard of depth

ascertained in the last certificate of survey, by reason of the abstraction of the waters of the River Vartry, or otherwise by the corporation of Dublin, the corporation of Dublin shall, for ever thereafter, at their expense, maintain such standard depth of water in the said harbour and channel as shall from time to time be certified to have existed at the time of making the last preceding certificate of survey, by all such artificial appliances and works of maintenance, as the Lord High Admiral or commissioners shall think necessary." "And, if the corporation of Dublin shall not proceed with the necessary works to repair or remedy any or every such damage or deterioration within one month after notice given by the Wicklow harbour commissioners to the said corporation, with the sanction of the Lords of the Admiralty (such notice to be served in like manner as the notice of an action about to be commenced at common law), the corporation of Dublin shall forfeit to the Wicklow harbour commissioners £20 for every day during which such damage or deterioration shall have existed; and each and every such penalty shall be a debt due to the Wicklow harbour commissioners for the time being by the corporation of Dublin; and if not paid on demand may be sued for, and recovered accordingly."

A discussion ensued with regard to the mode in which the rights of water supply enjoyed by the Earl of Meath should be protected, or rather in which way compensation should be afforded, for the extent to which those rights would be interfered with by the present bill.

Mr. GREGORY suggested that the corporation should purchase all the rights enjoyed by the Earl of Meath in the Liberties of Dublin.

Mr. BARRY said the corporation did not object to compensate the Earl of Meath for the loss he would sustain by the compulsory powers of supply for domestic purposes, taken under the present bill; but, as they would not interfere with his lordship in the supply at present given to manufacturers, they objected to be fixed with compensation for claims on that account.

After some consultation, the committee agreed to the terms of a clause calculated to protect the substantial interests possessed by the Earl of Meath, and decided that a formal meeting on Monday would be necessary to sanction this arrangement.

All the other clauses were then agreed to; and the proceedings of this protracted inquiry terminated.

[*For remainder of Parliamentary Proceedings, see the Supplement. The reports of the Blackburn and Stockport Water Bills, and the Huddersfield Gas Bill, will appear in the next number.*]

Legal Intelligence.

VICE-CHANCELLOR'S COURT.

MONDAY, APRIL 22.

(*Before Vice-Chancellor* WOOD.)

POSTLE *v.* BURY ST. EDMUND'S GAS COMPANY.

The plaintiff, being the holder of a large number of two classes of shares, called old and new shares, the question to be determined was, whether the directors had power to order a differential dividend between the two classes of shares? The new shares, no doubt, were not entitled to more than 7½ per cent.; but the plaintiff alleged that, up to 7½ per cent., the dividends must be rateable on the entire capital. There was also a minor question, whether two differential dividends, which had been previously declared, ought to be set right in making the next dividend? In February, 1860, the directors declared a dividend of 6 per cent. on the old capital, and about 5 per cent. on the new; in August, 1860, 6 per cent. on the old, and 5 per cent. on the new; and the proposed dividend, at the time the bill was filed for an injunction to restrain them, was at the rate of 8 per cent. on the old capital, and about 6 per cent. on the new. By the Act incorporating the company, it was declared that the capital should be £12,000, in 1200 shares of £10 each. That Act said nothing about any restriction on the amount of dividend, and, therefore, it depended upon the General Gas Act, 12 Vic., cap. 15., sec. 30, by which it was enacted that the "profits of the undertaking, to be divided among the undertakers in any year, shall not exceed the prescribed rate; or, where no rate is prescribed, they shall not exceed 10 per cent. per annum on the paid-up capital of the undertaking, which, in such case, shall be deemed the prescribed rate, unless a larger dividend shall be at any time necessary to make up any previous dividend which may have fallen short of 10 per cent." The company proceeded to work upon the capital of £12,000 till 1859, when they obtained another Act of Parliament authorizing them to raise additional capital to the extent of £18,000, making the entire capital £30,000. These new shares having been issued, the plaintiff took the number she was entitled to as a holder of old shares.

Mr. WILCOCK, Q.C., and Mr. ROXBURGH, appeared for the plaintiff, and contended that the general principle of law was, that in a partnership, where there was nothing to the contrary provided by the partnership deed, each party bringing in capital would have his share of profit, according to his proportion of capital, especially when the capital was called shares. The Companies Clauses Consolidation Act provided that, "previous to every ordinary meeting at which a dividend is intended to be declared, the directors shall cause a scheme to be prepared showing the profits, if any, of the company for the period since the preceding ordinary meeting, at which a dividend was declared, and apportioning the same, or so much thereof, as they may consider applicable to the purposes of dividend, among the shareholders, according to the shares held by them respectively." What were the directors to do with the divisible profits? They were to apportion them among the shareholders, according to the shares held by them respectively, and according to the amount paid thereon. The case, therefore, stood thus—that in February last the plaintiff had paid £10 on 133 old shares, and £1. 10s. per share on 207 new shares; and, therefore, the principle would be this—that, as £1. 10s. was to £10, the dividend would be apportioned. The Act, authorizing the raising of £18,000 additional capital, had said that both the old and new shares should form one capital of £30,000, and, therefore, up to 7½ per cent., the plaintiff contended that no differential dividend could be paid, the Act stating that on the £18,000 the dividend should not exceed "£7. 10s. per cent. per annum, on an average of the three then preceding years; and that rate of £7. 10s. per cent should for the purposes of the clauses, with respect to the amount of profit to be received by the undertakers when the gas-works are carried on for their benefit, be the prescribed rate of dividend." There was also another point, with reference to past dividends.

The VICE-CHANCELLOR: It has been held that you cannot call back old dividends.

Mr. WILCOCK: That would be left to the court. It was important to the plaintiff to know whether the directors had the power which they had assumed, because it had a material effect upon the value of her shares, as intending purchasers might say—"Although these shares are now paying a good dividend, the directors may, at the next meeting, declare no dividend upon them at all, if they are justified in the exercise of discretion in the matter."

Mr. ROLT and Mr. TERRELL appeared for the company, and left it to the court to say what course the directors ought to pursue, although they were of opinion that they had exercised a wise discretion in the course which they had pursued.

The VICE-CHANCELLOR said: I really think the mistake arises on the part of the directors, in this case, from mistake as to the operation of the section of the Public Gas Act, with reference to the limitation of dividend—a limitation followed in the second Act, providing, for the one, 7½ per cent., and the other, 10 per cent. The object of that section was not to direct, as between the company and the directors, what the shareholders should be entitled to, as between themselves, either as regards one class of shareholders or another, or as to what rights the shareholders should have as against the directors of the company. Of course, the shareholders can only take such profit as is derived from carrying on the business. The Legislature never could say any set of shareholders shall be entitled to 10 or 7½ per cent., or any other sum; but the Legislature thought they could say—whether they did so or not, is another matter—as between the company and the public, we will limit the rate of profit; and, when you follow those sections in the General Gas Act, they give you a rate of 10 per cent. *ab initio*; but, when you get beyond that, and have recouped yourselves all the way back from the very first, you must reduce the price to the public. You may dip into the reserve-fund, if you have not had as much as 10 per cent.; but, when you have done so, it must go to the public in the shape of a reduction in the price of gas. Whether any human being can believe that will have the effect intended, is another question. It may have had some effect in other transactions of the Legislature, but I believe that no company has yet been found which has not contrived that there shall not be that surplus. It is not intended to be said, you shall have a right to 10 per cent., and another set of shareholders shall have a right to 7½ per cent.; but they say, as regards the public, you, the first set of shareholders, shall have a right to receive 10 per cent. from the beginning; and, as to the second set of shareholders now to be created, we say you shall stop as soon as you have been reimbursed 7½ per cent. That was entirely between the shareholders and the public at large. Now, as regards the company and the shareholders *inter se*, the directors had it perfectly in their control, when the shares were issued with the approbation of the company, to make any such regulations as they might think would be proper, to throw the expenses, rateably, upon the shareholders. They had the power to issue these shares with any conditions whatever; and, of course, they might have issued the new shares with any conditions they thought fit; and, subject to such conditions, the Act says, the capital shall be one. To all intents and purposes, except the limitation which, for the sake of the public, is imposed upon a certain set, that they shall not make more than 7½ per cent., as between the shareholders and the company, it is said, the shareholders shall hold equal rights—they shall be in the same position, one set as the other. It is one joint-stock company, with one capital; but the 5th section did empower the company, if they thought fit, to determine the time when, and the terms and conditions upon which, the new shares should be issued. They might have said, "As Parliament has cut you down to 7½ per cent., you must bear a rateable share of the expenses, in some shape or form." That the case would necessarily happen, is not by any means clear, because the rate might never be more than 3 per cent. to anybody; and there might never be, in any shape or way, enough to pay 10 per cent. to the original shareholders. I apprehend, if the shares had been put into the market, with a statement that whereas the Legislature has limited us to 10 per cent. from the time of our commencement, you, the shareholders, must take the shares subject to a power on the part of the directors, with the consent of the company, that is to say, such of the original shareholders as might be brought to vote upon the question, to say you shall have nothing at all until the company has paid 10 per cent. *ab initio* upon the old shares. I take it, in that case, the shares would not have commanded the premium in the market at which they were issued, in case the old shareholders had not chosen to take them, and being issued at a premium it is clear no such scheme as that could be contemplated or dreamt of. But, all I can do is to rely on the words of the Act, and I have only thrown out the former observations to show that it works no injustice. The words of the Act of Parliament are so plain, that I can see no reason for arriving at a contrary conclusion; nor, do I see any conclusion that could be got at properly by giving any other construction than this—viz., that the company have the power to issue shares, and make them all part of one capital, and, if they think fit to issue them without any conditions, they make them part of one capital by bringing them under the operation of the Companies Clauses Act. I think there can be no doubt about that. The court has already said several times that it cannot recoup past dividends, which is obvious, for the reason that they may have passed through hundreds of hands in the meantime. I think, Mr. Wilcock, that I ought to give you the costs of this bill, and I think it only reasonable against those who have had already a considerable profit, that the costs of this bill should come out of the general funds of the company. It is not upon any notion of misconduct on the part of the company.

Mr. ROLT: The back dividends, declared and paid, are not to be disturbed. The company to pay the plaintiff's costs.

The VICE-CHANCELLOR: Yes; that will be sufficient. There is no injunction wanted now.

Mr. ROLT: No, sir.

Mr. WILCOCK: The company have raised this question *inter se*, and this is something like a decision upon a will. The question is, as it is a mere matter of benefit to the company to have it decided, whether our costs should not be between solictor and client?

Mr. ROLT: I have no instructions, and I leave it to the court. I do not offer any opposition, but I have no power to consent.

Mr. WILCOCK: It is a difficulty arising in the administration of the company's affairs, which the directors have thought it necessary to bring under your honour's consideration, and, I think, the costs of both parties—my client being a very considerable shareholder—should be paid between solicitor and client; the solution of this difficulty being one as to the management of the company's affairs. It is as it were the company's own bill, to know how to proceed in the management of their affairs. The company itself is collective.

The VICE-CHANCELLOR: I do not think I ought to say anything about costs between solicitor and client, unless it is agreed.

Mr. WILCOCK: The company is, in effect, wrong in the exercise of its judgment. It has an erroneous view, and it is requisite that it should be set right in that view; and, even if it had been right, it might have been proper to be brought before the court.

The VICE-CHANCELLOR: I think it cannot be a very great matter, but, I say, I cannot do it in point of principle, because I should be giving it against the whole of the shareholders who are not here upon the record.

Mr. ROLT: I do not know whether it is necessary to give any direction as to the costs being paid out of capital or revenue.

The VICE-CHANCELLOR: I direct the costs to be paid by the company; and the directors will pay them as they would pay any other debt. There will be one set of costs for the directors and the company.

Mr. ROLT: Your honour makes no order as to the payment of the defendant's costs.

The VICE-CHANCELLOR: No; they will retain them.

Miscellaneous News.

EQUITABLE GAS COMPANY.

The Ordinary Half-Yearly Meeting of the Company was held at the Offices, John Street, Adelphi, on Tuesday, May 7—J. HOLDSHIP, Esq., in the chair.

The SECRETARY (Mr. Andrews) read the notice convening the meeting.

The minutes of the last half-yearly general meeting were read, and also those of the special meeting of proprietors, held on the 9th of January. At the latter meeting, a report was presented by the directors, in which they stated that the present debenture debt of the company was £65,050; that £20,000 was now required for extension of works then in progress; and it must be expected that, in the course of a few years, £15,000 more would be required for a like purpose. The directors considered that this was a favourable time for raising these sums, and paying off the debentures. By the 21st section of the company's Act, they were authorized to borrow £100,000; and, by the 39th section, they were empowered to issue new shares for the above purpose, instead of borrowing the same. The directors considered the latter course was the one which should be adopted, and, accordingly, recommended the same to the proprietors. The 53rd section of the Act provided that the new shares should be offered to the existing shareholders in proportion to the number of shares held by them; and the directors, therefore, proposed that £100,000 of additional capital should be raised by the creation of 4000 shares of £25 each, to be apportioned as above directed. The special meeting resolved unanimously that the report of the directors be received, adopted, and entered on the minutes; and the directors were authorized to raise £100,000 in the way proposed, making calls upon the shareholders as they might think meet.

The following report and statement of the profit and loss account, for the half year, was read:—

The directors have much pleasure in submitting, for your information, a statement of the last half-year's accounts. They will bear a most favourable comparison with any previous period.

The new gasholder, and the other additions to, and alterations of, your manufacturing plant, have been in operation during the past winter. These works have been carried out in a most efficient and satisfactory manner, and have enabled your directors to provide and distribute an abundant supply of gas of good quality to your consumers.

The directors are glad to report that, notwithstanding the early setting in of the frost, and long continued severity of the winter, they had no occasion to resort to any extraordinary means, or incur any additional expense in providing coals for their use, the stock on hand, and the supply from the contractors having been sufficient for all their requirements.

Of the new issue of shares, sanctioned at the extraordinary meeting held here on the 9th of January last, 3563 have been taken by those shareholders to whom they were offered; and there now remains 437 unappropriated, which your directors propose to dispose of by auction.

In conformity with the company's Act of incorporation, two directors and one auditor retire from office at this meeting—viz., James Birch Kelly, Esq., and Charles Henry Ausley Martelli, Esq., directors, and James Michael Holdship, Esq., auditor, retire by rotation; and, being eligible, they offer themselves for re-election.

The manufacturing and revenue account, and the balance-sheet for the half year ending the 31st of December last, as examined and certified by the auditors, will be laid before you; they exhibit a net profit of £11,022. 13s. 10d. which, with the balance of £118. 8s. carried over from the previous half-year, amounts to £11,141. 1s. 10d., from which your directors recommend a dividend of 50s. per cent, free of income-tax, being 5 per cent. for the past six months, and 5s. per share towards the arrears of dividend for the half year ending the 31st of December, 1854, as authorized by the Legislature.

Dr. *Manufactory and Revenue Account, for the half year ending December 31, 1860.* *Cr.*

To Tradesmen's accounts	£ 242	15	6	By Gas rental to Dec. 31, 1860	£32,563	10	9
Coals carbonized	13,569	0	9	Coke, sales and stock	5,616	7	6
Wages (manufacture only)	3,455	3	9	Breeze	361	6	6
Wages and expenses for coke and breeze	805	11	0	Tar	827	19	9
Rent, rates, and taxes	376	8	7	Ammoniacal liquor	223	19	7
Directors fees	500	0	0	Bad debts	22	16	6
Auditors ditto	30	0	0	Taxes returned by St. Margaret and St. John	272	1	8
Salaries	1,213	6	4	Balance of unappropriated profits to June 30, 1860	7,118	8	0
Collectors commission	295	4	3				
Stationery, stamps, &c.	86	12	4				
General charges, &c.	229	12	2				
Bad debts	110	5	11				
Allowances	150	13	6				
Wear and tear	5,060	5	0				
Dividends	7,000	0	0				
Interest on debentures	1,631	9	10				
General law charges	238	7	5				
Income and property-tax	283	4	1				
Parliamentary inquiry	587	8	0				
Unappropriated profits to June 30, 1860	118	8	0				
Net profits to Dec. 31, 1860	11,022	13	10				
	£47,006	10	3		£47,006	10	3

The CHAIRMAN: Our report, as you see, is short, but, as I think, pithy, and quite to the purpose. Still, for the benefit of those who wish to know a little more of the affairs of the company, I will detain you for a few minutes with two or three observations. The accounts now presented to you cannot but be considered satisfactory. Indeed, we have never come before you under such favourable auspices as we do at the present moment. In past times, we had many kinds of annoyance and difficulty to contend with, but, during the last half year, we have been enabled to carry on our operations peacefully and with success. I believe, as far as our consumers are concerned, we have given general satisfaction. We have had scarcely any complaints, and none that were not easily and readily met and remedied, so that everything has gone on satisfactorily to us and to them. By the account, you will see that the quantity of coals carbonized, amounts to the sum of £13,569. We have used during the half year 1487 tons of coals less than for the corresponding period of 1859; but we have manufactured 4½ million cubic feet of gas more, and our rental has increased by £2786, which I think you will consider is extremely satisfactory. Our leakage has been reduced to 16 per cent., which is 5 per cent. less than for the corresponding period of 1859. You will perceive that there is a charge of £587 in the accounts for parliamentary expenses, which was incurred in connexion with the Metropolis gas inquiry of last year. That, of course, will not occur again, and the law costs will I hope be less in our next account. Our wear and tear is reduced by about £1000 from the amount at which it stood in 1859. There is one item on the credit side of the manufacture and revenue account which we cannot expect to see again—viz., a return of rates to the amount of £272, but it is very satisfactory to have anything returned on that head. By the balance-sheet you will perceive that, at the end of last year, we were indebted to our bankers, £10,000, and that £5535 were due to tradesmen—those sums have since been paid. The item, "rates and taxes," has no amount put against it on the debit side, but £97 on the credit side of the balance-sheet. This is explained by the fact that, at the time the accounts were made up we owed £197 for rates and taxes; but, that being deducted from the £272 returned, to which I before called your attention, left a balance in our favour of £97. Altogether, as the result of the last half year's operations, we are enabled to pay you a dividend of 5 per cent. We do not speak of it as at the rate of 10 per cent. for the year, because we cannot tell what may happen in the next six months; still, we have every reason to anticipate that we shall be able to pay the same dividend at our next meeting, which shows a state of prosperity in the affairs of the company that none of us at one time could have dared to look forward to. But, beyond this dividend of 5 per cent. for the current half year, we are able to give you 1 per cent. on account of back dividends. Under the Gas Clauses Act, we should have been entitled to recoup ourselves for any defiiciency of back dividends, but the Metropolis Gas Act of last session limits us in this respect to the payment of deficiencies within the six years prior to our making 10 per cent. Even in order to do that, we should require a much larger sum than we are likely to have, but we thought it desirable to begin at the present moment, although we can only do it to the extent of 1 per cent. When we have exhausted the six years, we shall be entitled to lay by a sum of £20,000 as a reserve-fund, and after that, if we are able to continue the payment of 10 per cent. to you, we must reduce the price of gas to the consumers. It is clearly to the interest of the public, that we should as early as possible be in a position to pay the largest dividend we are allowed to give you, so that they may the sooner obtain a reduction in the price of gas, which reduction we shall be most willing to make. Considering that we are now in a prosperous state, the board have felt it their duty, though the circumstance is not mentioned in the report, to do something for their officers whose exertions have contributed to their success; and, in doing so, we believe we shall have your sanction and approval. We have presented our secretary for his general services, and his assiduous attention to the interests of the company with the sum of £100; we have also given a similar sum to our engineer at the works. Any one who has been there recently will perceive that he is efficiently performing his duties, and we feel that to his excellent management is due, to a large extent, the favourable results we are able to place before you. We have also raised the salary of our accountant who is a highly-deserving person, as I am sure your auditors will be happy to testify. We have given gratuities to the other officers equal to 10 per cent. upon their salaries, and I trust that what we have done in this respect, will meet with your hearty concurrence. With regard to the apportionment of the new shares, we were in some difficulty about that. We are required by the Act to issue them to the existing proprietors in the proportion of one new share to every old one, so that every share might receive the benefit of the distribution. We have not, however, been able to do so, because all the shareholders have not taken advantage of the option. There have, therefore, been only 3563 out of the 4000 apportioned, leaving 437 at present undisposed of. The company's Act provides that, if, after one month's notice, the shareholders fail to take up the shares to which they are entitled in the distribution, it shall be lawful for the company to dispose of those that are unappropriated for such sum as the company can obtain for the same. Now, we consider that the only fair way to act upon this occasion, and so as to give an equal benefit to all, is to dispose of the remaining 437 shares by auction, and whatever premium may be obtained by such sale will be for the good of the company generally. I will just mention, in conclusion, that though I had some fears lest the testing clause of the Metropolis Gas Act might seriously affect us, and cause great inconvenience, we have found that it does not do so. We have provided a proper place for the experiments to be made; and Dr. Aldis, a highly respectable gentleman, who has been appointed by the parish for the purpose, goes when he pleases to examine our gas; and I am happy to tell you that the result at all times is satisfactory. I beg now to move, "That the report of the board of directors, together with the accounts, as examined and certified by the auditors, be received, adopted, and entered on the minutes."

Mr. HADLAND: The testing of the gas takes place on the works, I suppose?

The CHAIRMAN: No; we are obliged to find a place for testing it apart from and within 1000 yards of the works. It was desired, on the other side, that the testing should take place in any part of the district, but we thought 1000 yards off the works was quite sufficient, and it was so decided on.

Mr. HADLAND: I will second the motion for the adoption of the report With respect to the issue of the remainder of the new shares, would it not be well to reserve the disposal of them for the present, if you do not require the money?

The CHAIRMAN: But we do want it; and I may mention that, before our next meeting, we shall require a further call of £5 on these shares. After that, I think we shall not need another call for twelve months. There are £20,600 of debentures falling due next November. [In answer to further inquiries, the chairman said:] The directors are not prepared to receive calls in advance, even for cancelling debentures. We have not yet decided as to the sale of the remaining shares, but due notice will be given when it is to take place.

The motion was then put, and carried unanimously.

Mr. MAUGHAN moved—"That a dividend, clear of income-tax, of £2. 10s. per share, being 5 per cent. for the six months ending the 30th of December last, and 5s. towards the arrears of dividend for the half year ending the 31st of December, 1854, be now declared, payable on and after Monday next, the 13th instant."

Mr. WATSON seconded the motion, which, after a brief conversation, was put, and carried unanimously.

The retiring directors and auditor were re-elected, and returned thanks on their appointment.

Votes of thanks to the directors and auditors for their past services were then adopted; and the chairman, having briefly acknowledged the compliment for himself and colleagues, the proceedings terminated.

ON THE LOSS OF LIGHT BY GLASS SHADES.

(From Silliman's American Journal of Science and Arts.)

SIR,—In the November number of your journal, I find a notice of my experiments on the loss of light by glass shades, with an account of additional investigations by Mr. Frank H. Storer; his communication induces me to offer some further remarks on the subject.

The experiments were intended to be of a practical nature, and were tried solely in order to ascertain (as I state in my letter to the London JOURNAL OF GAS LIGHTING) the loss of light occasioned by the use of the ordinary glass shades. It is not, therefore, quite correct for Mr. Storer to compare results obtained by the use of *flat* sheets, with the loss of light occasioned by *spherical shades*. He is right, however, in supposing that by "the loss of light," I intended to express "the actual diminution of the amount of light, falling for example upon the pages of a book held near to its source, which would be occasioned by the interposition of the shades enumerated."

Professor Verver had another object in view, and his experiments do not apply to this subject. He was investigating the illuminating power of gas when burnt in an argand burner, with, and without a chimney. The gas in these two cases is burnt under very different conditions, while in Mr. Storer's experiments, and those which I have tried, the gas was burnt under precisely the same circumstances, whether a shade was interposed or not, the only difference being in the substances through which the light was transmitted.

I conducted my experiments in the following manner—In order to avoid the trouble and inaccuracy arising from the use of a candle, I employed a gaslight as the standard of comparison throughout the trials of all the shades. This could easily be done, as in the blackened experiment chamber of the Liverpool United Gaslight Company, there is a duplicate set of apparatus, two governors, meters, burners, &c., being fixed at opposite sides of the room. The lights (which we may call A and B) having been made equal, and their respective consumptions noticed; the first shade (that of clear glass) was placed surrounding A, and the photometer-screen moved towards it, until both sides of the screen were equally illuminated, the reading on the photometer-staff was then found to be 1·118 on that side of the centre of the staff nearest A, or in other words, the proportion of light given by B (without a shade) was to the light given by A (with a shade), as 1 to $\frac{1}{1\cdot118}$, or as 1 to 0·8944, or the loss of light by the use of the shade was equal to 10·56 per cent. The first shade was then removed, and the next substituted, and so on, until the loss of light in each case was determined. After all the shades had been examined, the lights were again compared, and found to be equal as at first adjusted.

The quality of the gas, and the description of burner employed, do not affect the question, provided that the same burner is used throughout all the experiments. The burners I used, were "No. 3 fish-tails," consuming 3·7 cubic feet per hour. The gas was taken from the street mains.

By using a standard light of unvarying intensity, all the errors likely to arise from inequalities in the consumption of a candle are avoided, and much time is saved in making the experiments, as one or two observations with the photometer in each case are quite sufficient to insure accuracy.

The divisions on the photometer-staff, do not necessarily represent candles, but the proportion that one light under examination bears to the other, when one of them is taken as unity.

I may observe, that the single experiment made with a *sheet* of common window glass, was tried simply to confirm the result obtained by the globe of clear glass. The distance at which the glass is placed from the light, does not seem in the slightest degree to affect the amount of light transmitted through it. I am glad to find that my own experiments on this point, are so entirely confirmed by Mr. Storer's statement.

Liverpool, Dec. 28, 1860. WILLIAM KING.

NOTE BY MR. STORER.

In reply to the courteous letter of Mr. King, I must express my regret that he has not more explicitly stated the reasons which lead him to object to a comparison of results obtained by the use of flat sheets of glass, with those obtained when spherical shades are employed. That the light which is reflected back from the interior surface of one side of a lamp-shade, of any form, would be compensated for by that similarly reflected from the opposite side—and that no similar compensation could occur in my own experiments where only single sheets of glass were used,—is evident; but I am ignorant of any experiments which go to show that the amount of light which is cut off from a given surface by the interposition of a *flat* screen, is different from that which would be stopped by a *curved* screen *of the same material*. Let us suppose a precise example; in a large sheet of blackened tin we cut out an aperture, say of three or four inches diameter, and cement therein a flat sheet of ground glass, and, having interposed the apparatus between a flame and the photometer, determine how much light is cut off by the glass, *i.e.*, bring the photometer to rest, as it were:—if now, having done this, we remove the flat sheet of glass, and fasten in its place a segment of a lamp-shade of a material identically similar with that of the flat sheet first used, shall we find that our photometer is no longer in equilibrium? The same amount of light must have in each instance passed into the aperture in the sheet of tin;—why should it not be transmitted to our photometer in the same way in either case? The experiment cited would probably be difficult to carry out in practice, since it would not be easy to find curved and flat screens of ground glass of precisely the same material, or ground equally rough. I state it merely in order that the conditions of the problem may be clearly understood, and with the desire that some proof may be given that the transmitted light would be less in one case than in the other,—a supposition not in accordance with received theories (see Art. Light in *Encyclopædia Metropolitana*, p. 347, §§ 42, 43,); nor would it be inferred from what is known of the analagous case of radiant heat, (see Lame, *Cours de Physique de l'Ecole Polytechnique*, second edition Edit. Paris, 1840, i, 309).

On the other hand, looking at the question in its practical bearing, it is clear that all lamp shades are not spherical. Witness, for example, the flat sheets of coloured or ground glass used by the cars upon our street railways, the flat sheets of plain glass of the street gas lanterns, and the flat sheets of ground, enamelled, or coloured glass in the out-of-door lanterns of eating-houses, &c.; to say nothing of the shades constructed of flat porcelain transparencies, which are so commonly employed in this country to soften the glare of gas-lights; or of the lanterns of coloured and enamelled glass, which were so often exhibited in the torch-light processions of the Presidential campaign of the autumn of 1860, and by which the phenomenon of "loss of light by glass shades," now under discussion, was so strikingly exhibited. In instituting a new series of observations, I, therefore, chose to make experiments, the results of which might be added to those of Mr. King, rather than to repeat the work which he had already so faithfully performed. In publishing my results, I regarded them as being merely supplementary to those of Mr. King, neither intending to institute any comparison between the two series of observations, nor directly to compare his spherical shades with my flat sheets. I intended to state only that my own experiments corroborated those of Mr. King, in so far as they went to prove the *great loss of light* occasioned by the use of glass screens.

As for the experiment of Professor Verver, to which Mr. King takes exception, he must pardon me, if I persist in maintaining that the observation does apply to the question at hand. It matters little in science, at any time, what *object* an experimenter may have in view, so long as the truth is attained and exhibited by his researches; but in the case in point, Verver's experiment, so far as it goes, applies directly to our subject. (See his own words, this Journal, Nov., 1860, [2.] xxx, 421.) Since, as I remarked in my previous note, the gas was indeed burned under somewhat different conditions in the two stages of Verver's experiment, his result must consequently be regarded as merely approximate; but, before seeking to discard it altogether, Mr. King should have remembered that a globular glass shade surrounding a fish-tail burner, is in some measure a *chimney*, and that, therefore, his own results cannot well be *entirely* exempt from the same source of error which affects the experiment of Verver. In making this remark, I would not in the least degree imply that Mr. King's observations are not most excellent. For my own part, I entertain no doubt of their accuracy;—for, throwing out the conceivable slight error to which I have alluded, his method of experimenting is unquestionably the best which is yet known. I urge only that the observation of Verver, must not be rejected.

Boston, Feb. 6, 1861. FRANK H. STORER.

PORTRAIT OF THE LATE MR. A. WRIGHT.—An admirable likeness of this talented and much-lamented engineer has been engraved by Mr. Joseph Brown, of Forest Hill, Sydenham, from a photograph by Mr. Wild, of the Great Central Gas Company. The style adopted is similar to that of the well-known portraits of Sir S. Morton Peto and Mr. Geo. Lowe, by the same engraver; and, as a work of art, it possesses great merit, and will afford much gratification to the numerous friends and admirers of one whose premature loss they sincerely deplore.

DR. J. NORTHCOTE VINEN'S FORTNIGHTLY REPORT ON THE GAS SUPPLIED BY THE SURREY CONSUMERS COMPANY.—

Week ending. 1861.	Number of Observations.	Maximum Light. Candles.	Minimum Light. Candles.	Average Light. Candles.
May 11	4	15·09	12·84	14·01
„ 18	4	15·33	13·26	14·01

The volume of hydrocarbons averaged 4½ per cent.; carbonic acid, 1 per cent. There was no trace of sulphuretted hydrogen. Ammonia was present on May 7, 10, 14, and 18; the indications of its presence were strongly marked on the 14th only. The maximum pressure was 2 inches 3/10ths; the minimum, 2/10ths. The ordinary working pressure averaged 7/10ths of an inch.

Advertisements.

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THE Undersigned hereby caution Meter Manufacturers and others against infringing the exclusive right of the Undersigned to the use of the Screw Adjustment for regulating the Height of the Overflow-Pipes in Wet Gas-Meters, as described in the Specification of the Letters Patent granted to Crosley and Goldsmith on the 19th of April, 1856; as well as against infringing any other portions of that or any other Patent of the said William Crosley; and

NOTICE is further given, that all Infringers of the said Inventions, or any portions of them, will be proceeded against. CROSLEY & CO.,
103, SOUTHWARK BRIDGE ROAD,
LONDON, Aug. 29, 1859.

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WOLVERHAMPTON PATENT WROUGHT-IRON TUBE WORKS,
Originally established in 1833,
Manufacturer of Gas and other Tubes, Fittings, and articles of every description belonging to Gas, Water, or Steam.

E. D. had the honour of receiving the
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awarded to this Manufacture by the COUNCIL of the GREAT ENGLISH EXHIBITION of 1851; and from he latter date has supplied many towns exclusively with GALVANIZED and other Tubes for Gas and Water, under GOVERNMENT ENGINEERS.

A City, containing 150,000 inhabitants,
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to resist 6000 lbs. and upwards to the square inch, extensively manufactured.

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Every Tube carefully tested with Hydraulic Pressure before leaving the Works.

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The Directors will receive Tenders until the 28th instant.

J. H. COX, Secretary.

Sunderland, May, 1861.

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ON SALE, at the Ashton-under-Lyne Gas-Works, one of Anderson's patent GAS-EXHAUSTERS, made by Balfour and Co., of Leven. Cylinder, 14 in. diameter, by 2½ ft. stroke. Being replaced by a larger one, it is in first-rate condition, and can be seen working.

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RICHARD JONES.
Engineer to the London Gaslight Company.
Vauxhall, London, Nov. 9, 1859.

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By Order, JOHN READ, Secretary.
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The Fire playing on the back and two side walls, also covering arch in common settings, is permeating on larger-sized retorts. An effectual method devised for destroying the incrustation of Carbon inside Retorts. The patent Retorts and Furnaces are more easily repaired than the common settings.

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I am, dear Sirs, your obedient servant,
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Rye Gas-Works.
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W. and G. would respectfully call the attention of Gas Engineers and Managers to their Station-meters, having made and erected the largest in use at the present time, two of which may be seen at the Stockport and Liverpool Gas Works, on application to the respective Engineers.

STOURBRIDGE FIRE-CLAY WORKS.
E. BAKER and CO.
(Contractors to Government).
21 WHARF, HARROW ROAD, PADDINGTON, W.
Every article manufactured at their own Works and Mines, Brierley Hill.
FIRE-BRICKS, Lumps, Squares, Tiles, and Gas Retorts of all dimensions.
CRUCIBLE and CEMENT CLAYS.
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CLINKERS and STABLE PAVINGS, noted for hardness and durability, being perfectly non-absorbent.
Shipments on the shortest notice.

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GAS ENGINEERS, IRON & BRASS FOUNDERS,

Alliance Foundry, 147, East Milton Street, and Barrowfield Iron-Works,

GLASGOW;

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MANUFACTURERS OF

STATION & CONSUMERS METERS, ALL SIZES;

WROUGHT-IRON TUBES, FOR GAS, WATER, & STEAM; CAST-IRON RETORTS & PIPES;

HYDRAULIC MAINS, CONDENSERS, WASHERS, SCRUBBERS, PURIFIERS, & TANKS.

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FIRE-CLAY GAS RETORTS,

Made of the most refractory Clay in the world, possessing extraordinary properties of contraction and expansion without cracking; having a true form, and perfect internal smoothness.

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Made up to five feet diameter. Vitrified Pipes, for conveying Water under pressure, made, laid, and guaranteed to stand a required pressure for six months. Every description of sanitary goods.

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EDWARD BROOKE, Fieldhouse Fire-Clay Works, Huddersfield.

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Successors to the late firm of J. and W. KING,

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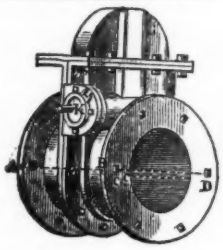
GAS-RETORTS, CLIFT'S PATENT GAS-OVENS and FIRE-BRICKS

OF ALL DESCRIPTIONS,

the superior quality of which will, they are confident, secure them further orders.



BRYAN DONKIN & CO.

keep always on stock their

IMPROVED GAS VALVES

from 2 inches to 18 inches, price 11s. 6d. to 13s. 6d. per inch diameter

List of prices, with full dimensions of all sizes up to 27 inches, to be had on application.

These Valves are all proved to 30 lbs. on the square inch before leaving the works.

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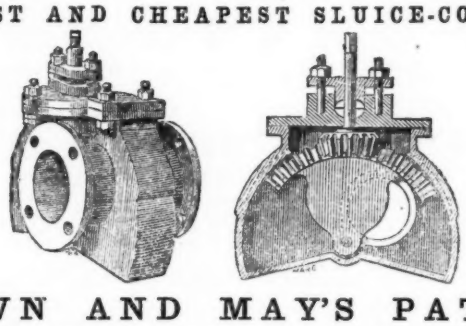
NEAR GRANGE ROAD, BERMONDSEY.

BEST AND CHEAPEST SLUICE-COCK.



BROWN AND MAY'S PATENT.

Above 3-inch diameter, price 10s. per inch. Brass face, 6d. per inch extra.

Can be taken to pieces without being removed from the line of Piping.

NORTH WILTS FOUNDRY, DEVIZES.

Wholesale Agents, Messrs. S. and E. RANSOME, 31, Essex Street, Strand, E.C., Where a Sample may be seen.

WALTER FORD,

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PADDON and FORD,

GAS-METER AND APPARATUS WORKS,

GRAY'S INN ROAD, LONDON.

MANUFACTURER OF WET AND DRY GAS-METERS, STATION-METERS, GOVERNORS, &c. &c.

A large number of **STATION-METERS,** up to 80,000 feet per hour (being by far the largest in use), and **GOVERNORS** for **MAINS,** up to 24 inches, have been constructed by Paddon and Ford. These Meters and Governors possess peculiar advantages as regards strength and freedom of action.

Sole Manufacturer of **PADDON'S PATENT STREET-LAMP REGULATORS,** for insuring any required consumption. These Regulators are in general and increasing use, and references can be given to Gas Companies who use them for every Lamp.

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PATENTEE OF

DRY & IMPROVED WET GAS-METERS,

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GAS APPARATUS.

All Meters warranted to comply with the Act of Parliament.

F. & C. OSLER,

45, OXFORD STREET, LONDON;

Manufactory—Broad Street, Birmingham—Established 1807,

MANUFACTURERS OF GLASS CHANDELIERS, GLASS LUSTRES, TABLE GLASS, &c. &c.

ELEGANT CRYSTAL GLASS CHANDELIERS, for GAS, from £4 upwards (Made from "REGISTERED" DESIGNS), with GLASS BRANCHES, &c.; suitable for DRAWING-ROOMS and BALL-ROOMS. The more extensive use of GAS in private dwellings has induced Messrs. OSLER to direct their particular attention to the manufacture of this class of articles—which, with a view to their general adoption, are offered at very moderate prices. Purchasers can select from a great variety of patterns, to which additions are being constantly made.

THEATRES, CONCERT, ASSEMBLY, AND BALL ROOMS LIGHTED BY ESTIMATE ON THE LOWEST TERMS.

JAMES OAKES and CO.,

ALFRETON IRON WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 20, WHARF ROAD, CITY ROAD, LONDON,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including best cold-blast Iron Retorts, Socket and Flange Pipes of all sizes, Bends, Branches, Syphons, Lamp Columns of various patterns, &c.

N.B.—Orders for Cast-iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.

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C. H. is prepared to carry out the warming and ventilation of public buildings, &c.; also civil engineering in general.

BIRTLEY IRON WORKS,

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Manufactory for every description of Casting and Machinery for Gas Works and Water Works.

Warehouse in London for Cast-iron Pipes and Connections of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Office in London, Mr. E. M. PERKINS, 78, Lombard Street.

JOHN ROGERSON and CO.,

NEWCASTLE-ON-TYNE & MIDDLESBRO'-ON-TEES.

Wrought and Cast Iron Pipes, Cast-Iron Retorts, and all kinds of Foundry Work necessary for Gas-Works. Fire-Bricks and Clay Retorts. Gas Coals of every description. Pig, Bar, and Plate Iron.

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12, ROYAL EXCHANGE BUILDINGS.

WROUGHT-IRON Guides for Gas-HOLDERS, when Trussed upon scientific principles, are more capable of resisting strains, in every direction, than Cast Columns of any form can be; and weigh only one-fifth as much as the latter. Designs and Working Drawings for Guides and Ties can be obtained of the Inventor, CHARLES DIXON, C.E., Chichester, SUSSEX.

GAS COAL.

BEAL, WALKER, and CO., Coal and COKE MERCHANTS, No. 1, Walker's Buildings, SHEFFIELD, beg to inform the Directors and Managers of Gas Companies, that they are in a position to contract for the supply of the different sorts of best Gas Coal, such as best Silkstone, Barnsley, and others, at the lowest prices, which may be had on application at the above Office.

ALFRED PENNY, Gas and

CONSULTING ENGINEER,

WENLOCK IRON WORKS,

21 & 22, WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, T-pieces, &c. &c.

Plans, Specifications, and Estimates prepared.

Gas Stoves, Gas Baths, Gas Cooking APPARATUS, warranted the best in England, at PHILLIPS'S, the original inventor and manufacturer, and general gas-fitter, &c., 55, Skinner Street, Snow Hill, LONDON, E.C.

PATENT SAFETY ATLAS CHANDELIERS, Sun and Star Burners, Outside Lamps, Patent Reflecting Lamps, Portable Coppers for either Gas or Fuel. Iron Tube and Fittings. Best quality for Gas, Steam, or Hot Water, &c. &c.

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DIRECT-ACTING GAS-EXHAUSTERS,

supplied either with or without Steam-Engines and Boilers.

FOUR-WAY DIAPHRAGM VALVES,

one of which answers the purpose of THREE ordinary Valves, as applied to Purifiers, or in shutting off and passing Station-Meters, Governors, or other apparatus, while the Connecting-Pipes are also much simplified.

RETORT SETTINGS,

designed to be heated by Tar alone, and with a total absence of Smoke.

Illustrated circulars, giving references and every information, may be obtained on application as above.

BENJAMIN GIBBONS, Jun.,

DEEPDALE FIRE-CLAY & BRICK WORKS,

Near DUDLEY,

Manufacturer of every description of Fire-Bricks, Lumps, Quarries, Shields, Flue Covers, &c., to any size or shape required.

FIRE-CLAY RETORTS,

TO MODEL OR DRAWING.

B. G. begs to call the attention of Gas Companies to his Fire-Clay Retorts, which have been used with great satisfaction in some of the largest Gas-Works in the Metropolis and many Provincial Towns in England.

References given, if required.

WILLIAM INGHAM AND SONS,

WORTLEY FIRE-BRICK AND RETORT WORKS,

Near

Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY,

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

Estimates for Setting, or Bricklayers sent when required.

GAS OVENS IN SEGMENTS OF EQUAL QUALITY.

A large stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all sizes kept in London at CHRISTIE & CO.—Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.

N.B.—*Export orders continue to have prompt attention.*

LIVESEY FIRE-CLAY WORKS,

NEAR BLACKBURN, LANCASHIRE.

ORLANDO BROTHERS,

MANUFACTURER OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

TRUSS'S PATENT ELASTIC PIPE-JOINT,

FOR GAS AND WATER-MAINS, AND STEAM PIPING,

Is the only PERFECT joint that has ever been constructed, and supplies the long-felt desideratum, by allowing for the expansion and contraction of metals, and for oscillation and deflection, without impairing the joint. Gas Companies will effect an incalculable saving in adopting it, as compared with the present imperfect mode of jointing.

Drawings, Estimates, and every particular, furnished on application to

THOMAS SEAVILLE TRUSS, C.E., 53, GRACECHURCH STREET, LONDON, E.C.

EDWARD COCKEY AND SONS'

PATENT GAS VALVES.

These Valves are formed of two Cast-Iron Cylinders, with segmental divisions, having the faces ground gas-tight—the upper Cylinder turning horizontally on the lower one.

The lower Cylinder has pipes from each division, communicating with the vessels to and from which the gas is to be passed. The upper Cylinder has corresponding divisions, so arranged as to direct the passage of gas to the different segmental divisions in the lower part, and when it is turned on the face of the lower one, to alter the flow of gas from one vessel to another.

Each Valve has an index-plate provided, which is to be attached to the floor, and a pointer on the cover of the Valve shows which way it is turned. Thus, the Manager of the Works can at once see in which direction the gas is passing.

There are about fifty of these Valves now in use, of sizes varying from two to twelve inches, and they are giving great satisfaction. Amongst the Works at which they are fixed, the following may be mentioned:—

BASINGSTOKE.	CANTERBURY.	FROME.	RYDE.
BLANDFORD.	ENNISCORTHY.	GODALMING.	SANDWICH.
CHELTENHAM.	ELGIN.	NEWPORT.	WARMINSTER.

They are in course of erection at other important Works.

IRON WORKS, FROME SELWOOD.

EDWARD COCKEY AND SONS

ALSO MANUFACTURE

PURIFIERS, SCRUBBERS, CONDENSERS, AND OTHER IMPROVED GAS APPARATUS,

HAVING PATTERNS SUITABLE FOR GAS-WORKS OF DIFFERENT SIZES.

WILLIAM SUGG,

MANUFACTURER OF

PATENT DRY AND WATER GAS-METERS, TEST GASHOLDERS, AND APPARATUS,

"EVANS'S" PHOTOMETERS,

Experimental Meters, Minute Clocks, &c., Station Meters and Governors,

STREET-LAMP GOVERNORS AND LAVA BURNERS,

19 and 20, MARSHAM STREET, WESTMINSTER.

CROSLEY & GOLDSMITH'S

PATENT SELF-ADJUSTING & COMPENSATING GAS-METERS

CANNOT BE OVER OR UNDERCHARGED WITH WATER,

and they consequently register the quantity of Gas consumed with greater accuracy than Meters in which the Water-Line is variable.

MANUFACTURED BY

CROSLEY & CO.,

GAS-METER MANUFACTURERS,

103, SOUTHWARK BRIDGE ROAD, LONDON, S.E.

N.B. The Patent Self-Adjusting and Compensating Apparatus may be applied to the ordinary Meter.

Manufacturers of LOWE'S PATENT MOTIVE-POWER METER, for situations where there is an inadequacy of pressure to supply the special requirements of certain consumers in low grounds during the day or night.

Also, Manufacturers of EXPERIMENT METERS, GOVERNORS, MINUTE-CLOCKS, PHOTOMETERS, &c., &c., similar to those used by Mr. King, of Liverpool.

CROSLEY & CO. are also prepared to supply Gas Companies and others with

DUPLICATES of Mr. KING'S CUBIC FOOT TRANSFERRER,

similar to that manufactured by them, and verified by the ASTRONOMER ROYAL, and PROFESSOR MILLER, of Cambridge, on behalf of the Government, which was deposited by C. & Co. in the Office of the COMPTROLLER-GENERAL of the EXCHEQUER before Nov. 13, 1859, in compliance with the "Act for Regulating Measures used in Sales of Gas." They also supply

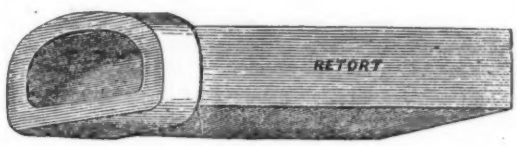
TEST GASHOLDERS,

Graduated by the Standard Cubic Foot.

C. and Co. are the only house in the trade which has for years manufactured Meters according to the standard measure set forth in the 2nd Section of the "Sale of Gas Act," and which also comply with the rules laid down in the Section for testing meters. Purchasers of C. and Co.'s Meters may therefore be secured against any additional expenses being incurred in order to adapt their Meters to the requirements of the new Act.

KING BROTHERS,

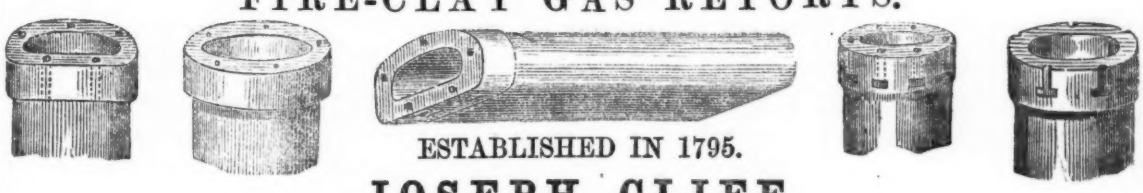
STOURBRIDGE FIRE-BRICK AND RETORT WORKS.



KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them FREE FROM CRACKS AND CORRECT IN FORM. By great care in Manufacturing, combined with the advantages in burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonize.

Retort Ovens, Fire-Bricks, Guards, Saddles, Rabbitted Burs, Flues, and Quarries, are all Manufactured of the same quality of Clay. Every Retort and Brick is branded "King Brothers, Stourbridge."

FIRE-CLAY GAS RETORTS.



ESTABLISHED IN 1795.

JOSEPH CLIFF,

WORTLEY FIRE-BRICK WORKS, near LEEDS.

THESE RETORTS are unrivalled in excellence, being the BEST FINISHED INTERNALLY, and THE MOST CORRECT IN FORM, of any in the Kingdom. From the peculiar composition used in working up the face of the material, they are rendered unusually smooth, close, and FREE FROM SURFACE CRACKS, thus, in a great measure, preventing leakage and the adhesion of carbon to their interior surface.

To meet the yearly increasing demand of UPWARDS OF THIRTY SEASONS and to carry out the late improvements in the manufacture, the Premises have been re-erected and much enlarged, and Engineers may rely WITH CONFIDENCE on their orders being completed with a greater regard to despatch than by any other House.

THE WORKS ARE WELL SITUATED

For EXPORT from the Ports of { LONDON, LIVERPOOL, HULL, MIDDLESBRO', HARTLEPOOL, and STOCKTON.

FIRE-BRICKS, LUMPS, GUARDS, TILES, AND CLAY OF THE SAME QUALITY.

M B NEWTON, London Agent, No. 4, Wharf, King's Cross Goods Station.

SALE OF GAS ACT.

MESSRS. CROLL, RAIT, AND CO.,

Manufacturers of Croll's Patent Improved

DRY GAS-METER,

Also Manufacture and Supply

TEST GAS-HOLDERS,

And other Apparatus required by the Inspectors appointed in pursuance of the above Act.

Application for particulars to be made to the Factory,

CANAL BRIDGE, KINGSLAND ROAD, LONDON, N.E.

ALEXANDER WRIGHT,

55 and 55A, MILLBANK STREET, WESTMINSTER, S.W.,

MANUFACTURER OF

CONSUMERS' COMPENSATING & NON-COMPENSATING WET GAS-METERS,

Of the best material and workmanship, carefully adjusted to meet the requirements of the SALES OF GAS ACT.

STATION-METERS & GOVERNORS,

WRIGHT'S REGISTERING PRESSURE-GAUGE, EXHAUSTER REGISTER, & REGULATOR;

STANDARD TEST GASHOLDERS;

Consumers' Governors; Inspectors' Pocket, King's, and all other kinds of Pressure-Gauges; Thermometers for Condensers, Pressure Registers, &c., &c.

EXPERIMENTAL TESTING APPARATUS,

Employed by the best experimenters in this country and on the continent, and by the Gas Testers in the London districts.

PHOTOMETERS, SPECIFIC GRAVITY APPARATUS, BI-SULPHURET OF CARBON TEST, THOMPSON'S BROMINE AND HEATING POWER OF FUEL TESTS, IMPROVED ALKALIMETER, EXPERIMENTAL METERS AND GOVERNORS, MINUTE CLOCKS, &c., &c.

"Analysis of Gas for Practical Men," by A. WRIGHT, M. Inst. C.E., post-free for 13 Stamps. PRICE-LISTS ON APPLICATION.

JAMES MEACOCK,

PATENT DRY AND WET GAS-METER MANUFACTURER,

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ESTABLISHED 1836.

J. M. invites attention to his Improvements in EXPERIMENTAL WET GAS-METERS, by which he renders impossible any Leakage from the Stuffing-Box.

These METERS are GUARANTEED to meet all the Requirements of the SALE OF GAS ACT

GOVERNORS, STATION-METERS, PHOTOMETERS,

EXPERIMENTAL TESTING GASHOLDERS, HIGH-PRESSURE GAUGES,

AND ALL APPARATUS IN USE AT THE GAS MANUFACTORY.

D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,

invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

MANUFACTURERS OF

GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas Apparatus.

CAST & WROUGHT-IRON PIPE, BLACK & GALVANIZED. COPPER. TIN, BRASS, & COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER

for clearing out Mains, Services, and Interior Fittings—60s. net.

Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns.

Sole Manufacturers of Church and Mann's Photometer.

Large Pattern Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.

London: Printed by WILLIAM BOUGHTON KING (at the office of Joseph Clayton, 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, May 21, 1861.